ELECTRONICS Australia

with CB and HIFI NEWS

AUGUST, 1978

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STEREO CASSETTE DECK | TC-K7II
SONY TAPE DECK REMOTE CONTROL | RM-30
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SONYS NEW TC-K7II

REDUCING WOW & FLUTTER TO LESS THAN 0·045%

Introducing the King of Sony's new K series cassette decks. The outstanding TC-K7 II with Sony's most advanced electronic and mechanical engineering.

This is a deck that not only has specifications that are superior to many open reel decks but features easy to operate, gentle touch, logic controls in all tape transport modes. There is no need to push the stop bar when changing modes and should the wrong mode be selected accidentally, no damage can occur to your tapes or your deck. All modes including ''record mute'' can be activated from the optional remote control unit (RM 30).

How do Sony achieve that incredibly low wow and flutter figure (0.045% WRMS). Firstly by using a two motor system, each designed to do a specific job. One motor is for reel drive and Sony's New Tri-Duty Motor handles the capstan drive. The Tri-Duty Motor is a superb piece of engineering and with its servo system,speed variations caused by either line voltage fluctuations or tape load are virtually eliminated.

The TC-K7 II features a ''Double'' integrated, recording and play back level indication system. Dual, high quality VU meters are augmented by three instant reacting LED peak level indicators, set at ''O'' and at +4 and +8 dB, so that the oversaturation of recording circuits can be prevented.

Naturally the TC-K7 II has Dolby but it also has an MPX filter defeat (Filter off) mode, a record mute facility and a three position memory rewind and replay facility. The tape select system has three step bias and three step equalisation selectors, giving nine possible positions, for optimum performance from a wide variety of tapes.

At the heart of this deck there's Sony's Ferrite and Ferrite head, hard and highly polished, like black diamond, to give years of head life.

The combination of Sony engineering and research with logic controls and Sony's new Tri Duty Motor produces a cassette deck that must be the choice of discerning Hi-Fi enthusiasts: A sound logical choice.

CHECK THESE EXCEPTIONAL SPECIFICATIONS

Frequency Response	20 Hz — 18,000 Hz (FeCr) 20 Hz — 17,000 Hz (Cr02)
S/N Ratio	60 dB (FeCr, Dolby off, peak)
Wow and Flutter	0.045% WRMS
Harmonic Distortion	1.3%

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ELECTRONICS Australia

Australia's largest selling electronics & hi-fi magazine
On sale the first Monday of each month

VOL. 40 No. 5 AUGUST, 1978

Our popular 200MHz 7-digit frequency meter has been upgraded, and can now measure to 40MHz without a prescaler. Full details on p42.

Low in cost and easy to build, our new timer/alarm unit features 11 useful time intervals ranging from 15 seconds to 4 hours. Turn to p50 for constructional details.

On the cover

Developed by Motorola Inc, USA, this new solar concentrator module is capable of producing 25 watts from a single 69mm cell. A second generation concentrator will use a 97mm cell and produce 39 watts. The lovely girl is Motorola employee Jeannie Stewart of Mesa, Arizona. For further details, see our story on p16. (Photo courtesy Motorola Inc.)

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How to get the sound of a whole new hi-fi system for around $35

Are you sure of the quality of your loudspeakers? Most people can't afford top quality speakers at first. So they upgrade the speakers later. If you're at that stage, you will know you're not going to do it for less than $200-$300 — not meaningfully.
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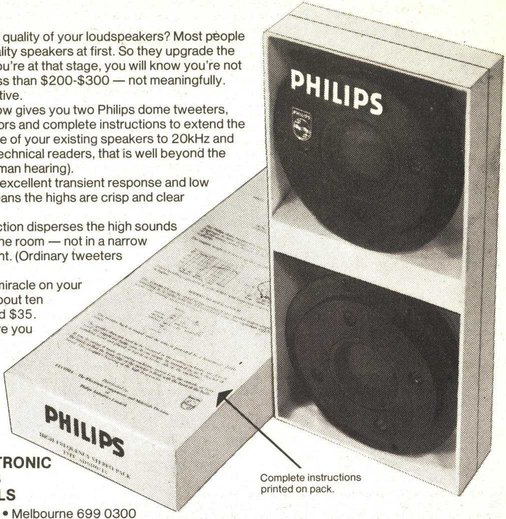
And they do it with excellent transient response and low distortion. (That means the highs are crisp and clear without grating).
The dome construction disperses the high sounds naturally all round the room — not in a narrow beam like a flashlight. (Ordinary tweeters can do that).
You can work this miracle on your stereo system in about ten minutes. For around $35.
Why not try it before you write a cheque for $300?



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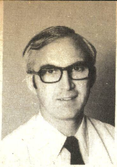

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Power from positive thinking?

During my trip to the USA a few months ago I was very interested to learn more about the research being done there into various aspects of solar energy, a lot of it by private companies.

At Lockheed Missiles and Space Company in Sunnyvale, California, for example, I learned more of the research which that company is doing into ocean-thermal-energy conversion or "OTEC" plants, which utilise the solar heat energy absorbed by the oceans. Lockheed has done a lot of work on OTEC development, and is currently negotiating to set up a pilot 50kW OTEC plant in Hawaii.

Similarly at one of the Motorola Semiconductor plants in Phoenix, Arizona I learned of the work being done there on concentrator-type silicon photovoltaic cells, which convert sunlight directly into electrical energy at high efficiency. I was so impressed with the results they have achieved that I arranged for us to get a story on it, which you'll find starting on page 16 of this issue.

The same firm is also concentrating on the development of silicon ribbon technology, which is expected to produce the next major cost breakthrough in silicon solar cells. They have developed a fabrication technique involving the initial growth of polycrystalline silicon ribbon, which is then zone-melted by a high power laser into single crystal form.

It seems to me significant that much of this work is being done by private companies. To be sure, a great deal of the funding for the initial research comes from the US Government in the form of research grants and feasibility study contracts. But the fact is that the firms themselves are keen to tackle the problems, because they know just how valuable the solutions are going to be to all concerned. And the US Government obviously believes that this motivation makes the private companies an efficient medium for turning research dollars into tangible results.

Of course the Americans also have the advantage of a government which has begun to think positively and constructively about energy resources and the future. In contrast with our own, which appears to me to have decided that because some of the problems may take either a few years to solve or a few years to reach crisis level, they'll not worry too much about them until then.

Quite apart from its serious long-term implications for Australia, this official apathy is discouraging our energy researchers and forcing them to go overseas.

I note, for example, that we are now losing Professor John Bockris of Flinders University — one of the acknowledged authorities on solar energy and the hydrogen economy. He is leaving to work in the USA, frustrated after years of trying to prod our indifferent authorities into action.

No one would claim that Australia could or should spend as much money as the USA on solar energy development. But we are rich in human and other natural resources, and with a positive approach instead of apathy I believe we could still achieve quite a lot.

— Jamieson Rowe

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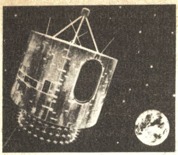


News Highlights

Australian-developed 5kW wind generator

A new wind-powered generator, nearing final testing in South Australia, has already created world-wide interest.

The generator produces 5 kilowatts, enough power to run an average suburban home. It has been designed and developed by the Dunlite Division of Philips Industries Holdings Ltd at Hindmarsh, South Australia.

Dunlite has, for a number of years, exported smaller windpowered generators to more than 30 countries. By far the largest export market is the United States, and Dunlite is confident that growing American interest in wind energy will result in increased sales of the new model.

"We have two representatives in the United States at present and they have reported tremendous interest in he new machine," Mr Jack Costi, Dunlite's Development Manager, said recently.

"Dunlite is well known in the United States. Late last year 'The Australian' reported that one of our wind-driven generators is the star of the United States' wind energy research station at Rocky Flats, Colorado.

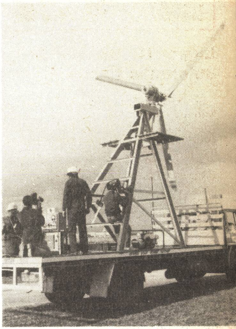
"'The Australian' quoted the US project manager, Mr Terry Healy, as saying the Dunlite generator 'is the best in the world' ".

Mr Costi said that China already had requested that the new model should go on display at an International Trade Fair in Peking during August. Last year, China bought three Dunlite 2kW models for its wind energy research program.

Gothenborg University in Sweden, which also has a Dunlite 2kW model, wants to buy the 5kW version as soon as it goes into production

Because Australia has no wind tunnel large enough to test the "windmill" section of the new machine, Dunlite engineers have been carrying out tests at Edinburgh RAAF Base in South Australia. The propellers, which are six metres in diameter, are mounted on a tall tower fixed to a truck. The truck is driven at speeds up to 100 kilometres an hour to produce different, but controlled, "wind" speeds.

According to the United States project manager, Mr Healy "The Australians are years ahead of us in wind technology". The United States market for wind-powered energy is estimated at $1000 million a year.



Prototype 5kW wind-powered generator undergoing tests at Edinburgh RAAF Base, South Australia.

Signetics on the comeback trail

When Philips took over control of Signetics Corporation from Corning Glass Works in early 1975, the semiconductor maker's sales had reportedly fallen to about $100 million. Clearly the company was in trouble. The bottom had fallen out of its 54/74 bipolar standard logic market — the company's bread-and-butter product line — and its proprietory non-industry-standard 2650 microprocessor had not made much headway against the 8080 and 6800 microcomputer families.

To make matters even worse, Signetics had not penetrated the potentially huge market in 4,096-bit dynamic random-access memories. Indeed, its best showing was in the much smaller cache and bipolar buffer memories, a market dominated by Fairchild Semiconductor.

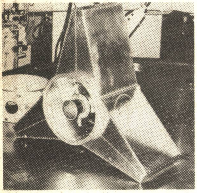
Three years later, the picture has changed dramatically. Under the sympathetic eye of the giant Philips Gloeilampen-fabrieken of the Netherlands, and with major capital infusion for new technology, Signetics ended 1977 with over $170 million in sales, or 35% over 1976. And Jack Halter, Executive Vice President and Director of Marketing, looks for the company to reach the $200 million level by the end of this year.

The company recently revealed a memory development program for the next two years that is unsurpassed by any in the industry On the list are 64k dynamic random-access memories, 32k and 64k erasable programmable read-only memories, 128k and 256k ROMs, 8k and 16k static RAMs, and 8k and 14k electrically alterable metal-nitride-oxide-semiconductor ROMs.

In the near term are the industry-standard 2114-type 4k statics, the 4116-type 16k dynamics, 32k and 64k ROMs, and 16k and 32k erasable PROMs, many already in the sampling stage.

In computer and related products, Signetics is now supplying, in addition to its own 2650-based central processor unit and peripheral parts, the 8080 family, including central processing units and 8080 peripherals.

Dick Smith sponsors satellite



Dick Smith Electronics has sponsored a complete solar panel, valued at $US2000, for the first AMSAT Phase III amateur satellite, The satellite is due for launch in December 1979.

AMSAT Phase III is a revolutionary new series of amateur communications satellites designed for long life operation over transcontinental distances for many hours at a time. Specialised tracking equipment will not be required to use AMSAT.

The AMSATs will all be funded by voluntary organisations. Dick felt that a large donation for the first satellite was a logical extension of his company's commitment to serve amateur radio and the short-wave listener in a practical manner.

Linear IC for automatic focussing

Scientists at Honeywell Incorporated, Minneapolis, USA, have developed what is claimed to be a fully practical automatic focussing system for camera lenses.

The new "autofocus" module, called Visitronic, uses an optical system to produce two images, together with a large integrated circuit to automatically sense a proper image match. The IC, which measures 2.5 x 6.35mm, has a light-sensitive detector array at either end.

One image is fixed; that is, it is received by one of the photosensor arrays by way of a fixed mirror and a set of lenses. A pivoting mirror reflects the other image through the optics onto the second photodetector array.

This second mirror scans the scene at which the camera is aimed, causing the triangulation point to vary from near distance to infinity, or vice versa. The IC then establishes at which point in the scan the two images are matched, and drives a control device to automatically focus the camera lens.

ATDA proposal on national satellite

The Australian Telecommunications Development Association has proposed that any development of a national communications satellite should be done on a team basis with the telecommunications industry working in unison with OTC and Telecom Australia.

The proposal comes in a supplementary submission made by the ATDA to the Task Force inquiring into a national communications satellite.

The Chairman of the ATDA, Mr A.T. Deegan says in the submission that it was his association's view that should the government decide to proceed with the project it should look to achieve:

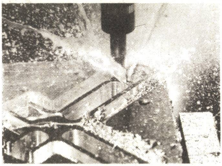
- maximum contribution within Australia, consistent with our capabilities and potential; and
- maximum transfer of skills and technologies to Australians so that we can cater for future developments in communication.

The submission continues: "The Industry's strength and hence its ability to contribute lies primarily in the development and manufacture of telecommunications equipment.

"What we are proposing aims at making optimum use of Australia's skills in both government and industry, the building up of these skills as required and in the process developing our own scientists and engineers for the future."

The submission concluded with the warning that if there was little or no local involvement in the development of a satellite system, employment levels in the telecommunications manufacturing industry would undoubtedly drop.

High-speed cutter



1.8km-A-MINUTE — Liquid coolant and metal chips erupt from an aluminium block being machined by a new high speed process at Lockheed Missiles & Space Co. The high-speed cutting tool zips through metal at approximately 1800 metres per minute, and enables the machine to turn out parts 3½ times faster than conventional equipment. The process leaves a clean and highly polished cut which eliminates the need for additional deburring and finishing operations.

Giant solar collector

This giant solar collector is one of several commercially-made collectors being evaluated at the solar test facility of the Lockheed Palo Alto Laboratories. The Lockheed solar facility is instrumented to National Bureau of Standards (NBS) specifications and can simultaneously test 10 different collectors and associated systems. Data gathered at the facility provides performance profiles of components and systems.

The collector in the foreground is a concentrating type made by the Hexcel Company of Dublin, California. Shown with the collector are Ron Dammann and Ed Lucero, operations technicians at the Lockheed solar test facility.

Big sales predicted for solar equipment

Sales for solar-powered home heating systems will increase by 44 per cent annually through 1990 to $1.7 billion according to Predicasts Inc, a Cleveland-based business information and market research firm.

The majority of growth, says Predicasts, will take place after 1983 when price reductions in solar equipment will be made possible by production economies of scale. At the same time, significant price rises are predicted for traditional energy sources.

By 1990, it is expected that over 3 million solar heaters will be in use in 3.5% of American houses. Heat pumps are also expected to achieve rapid growth because of their energy efficiency, dual heating and cooling functions, and suitability as a back-up systems to solar heating.

Predicast's surveys indicate that energy cost savings will be the primary impetus behind consumer demand.

NEWS HIGHLIGHTS

Business Briefs:

$280,000 Navy contract to Strato Communications

Strato Communications Pty Ltd, 25 Wentworth St, Parramatta 2150, has recently been awarded a $280,000 contract to supply hand-held VHF transceivers to the Australian Navy. Strato Communications was incorporated in 1962, and sells a wide range of VHF and UHF equipment and special surveillance devices.

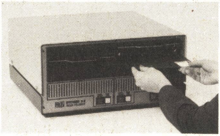
New subsidiary company for Trio-Kenwood

Trio-Kenwood (Australia) Pty Ltd has announced the recent establishment of a subsidiary company, Trio-Kenwood Communications Division (TKC). The new company has been established with the aim of promoting and distributing the range of amateur communications equipment manufactured by the parent company, Trio Kenwood Corporation of Japan. TKC has its own premises, including warehouse, showroom, offices, service department and spare parts store at 31 Whiting St, Artarmon, NSW 2064.

October trade tour to Japan, Korea and Taiwan

In conjunction with Astrid International Tours, Sydney, Mr Steve Colman of Pace International Pty Ltd is organising a trade fair tour to three important electronics shows in Japan, Korea and Taiwan. During the trip, tour members will be able to visit the following exhibitions and trade fairs: Japan Electronics Show; Japan Measuring Instruments Exhibition; Japan Analytical Instruments Show; JETRO Exhibition at Tokyo Trade Centre; Korea Electronics Show; Korean Autumn Fair 1978; KOTRA Permanent Exhibition; Taiwan Electronics Trade Fair; Taiwan Toys and Gifts Show; and CETDC Exhibition in Taipei. The tour will take place 5th-20th October, 1978. For further information contact Steve Coleman, PO Box 33, Killara, NSW 2071.

Export drive for Aust. medical computer



South East Asia has recently viewed the first totally Australian-made computing system ever to be shown overseas.

The system (both hardware and software are by Melbourne-based companies) has been designed for doctors and hospitals and was demonstrated in Singapore at the Royal Australian College of Opthalmologists 10th Annual Scientific Congress at the Hilton Hotel, April 30 — May 5.

From there it was flown to Kuala Lumpur to take part in the 51st Scientific Meeting of the Royal Australasian College of Surgeons from May 7 to May 12 at the Hyatt hotel.

Three Australian companies are behind the venture. Leading the team are Kim Luff, a director of SLE Medical Pty Ltd, who developed the software, and Bob Garde, software applications manager of Spectra Systems, a computer marketing company. For their demonstrations they used a Computex Spectrum-11, a microprocessor-based machine, designed and manufactured by D. D. Webster Electronics Pty Ltd.

Mr Luff's company spent nine months developing the software in close association with a group of medical practitioners.

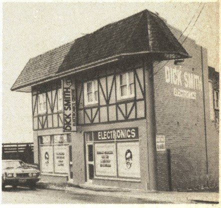
Spectra Systems has been selling its small computer since it was launched last July. It is based on the DEC LSI-11 processor and is available with 1 or 2 high performance floppy disc drives and 32k or 64k bytes of MOS memory.

The complete medical package (which includes hardware, software, installation, 12 months warranty and operator training) ranges from a basic and highly competitive $20,000 to $40,000 for more sophisticated versions.

Mr Luff said that the system had been tailor-made to suit three areas of the medical profession: specialists, general practice, and clinics and hospitals.

It includes comprehensive systems such as diary files or patient booking systems, debtor and general ledger, and patient file record systems, and is designed to improve efficiency.

Dick Smith now at Chullora



Dick Smith has moved from his Bankstown (NSW) store 2km down the Hume Highway to Chullora.

"This move has been necessitated by the tremendous growth in business at the Bankstown store since it opened in 1974", said Dick. "The building was virtually bursting at the seams. We couldn't get more space there, so we had no alternative but to take larger premises".

The new Chullora store at 147 Hume Highway has 223 square metres of showroom space compared with 65 square metres at Bankstown. A full range of electronic components, kits, amateur radio and CB equipment, hifi, books and tools is stocked there.

Refuse may provide energy

Further ideas abound for saving energy, both on the domestic and the industrial fronts. One is the refuse reactor, to provide fuel from domestic or industrial waste. Such refuse can be easily broken down by a distillation process called pyrolysis to provide quantities of methane gas.

The refuse is heated to high temperature in the absence of oxygen until the rubbish breaks down into its valuable separate elements. Methane gas is given off and this can be fed to the local gas supply and also tapped to provide heat to continue the distillation process itself.

Oil is also distilled as a vapour and can be collected in retorts where it liquefies. And left behind are a solid organic matter, char, which can also be compressed into a useful fuel, and metals.

The pyrolysis reactor has been developed to a commercial stage by Foster Wheeler, England, which specialises in boilers and refuse treatment equipment. This company is now offering a wide range of different reactor designs for sale, able to treat anything from three to ten tons of refuse per hour.

N.L.S. LEADS AGAIN?

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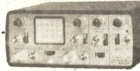
Features: 3½ digits, 0.5; accuracy, 3 digits plus 100% over-range, portable, batt operated, large LCD display, auto polarity, decimal and overload indication, no zero adjustment, no full scale OHMs adjustment, up to 15 hours operation on AA-size alkaline batteries.
Ranges: D.C. Volts, D.C. M.A., OHMS, True R.M.S. V.A.C. and A.C. M.A.
Options: Re-chargeable nico batts and charger, E.H.T. probe, Handle/Tilt stand, panel-mount flange.
PRICE $189.00*

Dual Trace Miniscope



M.S.-215 Miniscope

Features: Dual trace-2-channel; separate, chopped, or alternate modes, 15 mhz bandwidth, ext. and int. trigger, time base — 0.1 U/SEC to 0.5 sec/div-21 settings completely portable batt or line operation, auto or line sync modes, less than 15 watts power consumption, .01 to 50 volts/div-12 settings, weighs only 3lbs with batts.
Size: 2.9" high, 6.4" wide, 8.0" deep.
Options: Carry case, x10 probe.
Note: Single trace scope also available with same specs.
Price: Single trace **$325.00*** Dual trace $449.00*

LCD or LED Panel Meters

R.M. series D.P.M.

Features: Mos/LSI construction, fits DIN or NEMA cutouts, large 0.6" LCD or 0.5" LED DISPLAY, No zero adjustment, plug-in range change capability, programmable decimal point, o/load indication, auto polarity, i/p voltage protection, mating edge connection or terminal block.
Ranges: 0.2V, 2V, 20V, 200V or 1000V. Available in D.C. reading A.C. powered or A.C. reading D.C. or A.C. powered.
Size: 1.645" high, 4.072" deep, 3.580" wide.
Price: From **$47.00***

For further information, contact **Non-Linear Systems,** 61 Lothian Street, North Melbourne, Vic. 3051. Phone 329 9951 or your closest distributor.

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Scheduled to fly in space in late 1979, NASA's Space Shuttle Orbiters will be the world's first re-usable spacecraft. Lockheed Missiles and Space Company has developed a remarkable new insulating material to protect the Orbiters from high temperatures during re-entry into the Earth's atmosphere.

Heat protection for the Space Shuttle

A space-age insulation, which conducts heat so poorly that it can be held with bare hands while its interior is still red hot, is being manufactured by Lockheed Missiles and Space Company at its plant in Sunnyvale, California. Refined from common sand, the unique all-silica material (known as LI-900) will be used as a heat shield to protect space travellers of the 1980s aboard NASA's Space Shuttles.

Nearly 34,000 "tiles" of Lockheed LI-900 will be used to cover about 70 per cent of the surface of each spacecraft. They are expected to survive temperatures up to 1260°C for 100 flights, with only minor maintenance.

It is this feature that will make the Shuttle a truly reusable and economical space transportation system. Previously, all manned spacecraft used an ablative heat shield that was destroyed during re-entry into the Earth's atmosphere.

The overall economic feasibility of a reusable space transportation system thus hinges on protecting the vehicle from re-entry heat in a way such that it does not require significant refurbishment between flights.

Lockheed began investigating a broad range of candidate Shuttle insulating materials as early as 1957.

The range included zirconium compounds, alumina and aluminium silicates. After 1961, the work concentrated on finding a suitable all-silica material. An earlier, but heavier, version of LI-900 was successfully tested in 1968 during the re-entry of NASA's Pacemaker spacecraft.

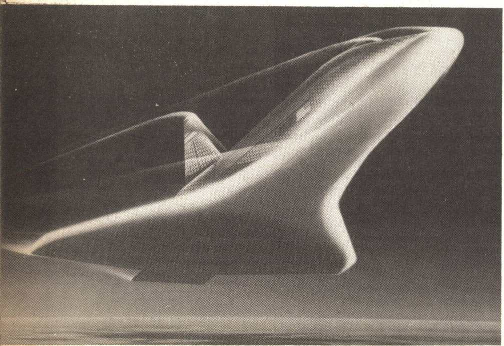
The basic raw material for LI-900 is a short-staple, 99.7 per cent pure amorphous silica fibre. Lockheed has more than 15 years experience with this material, and selected it for the Shuttle because of its light weight, low thermal conductivity, low thermal expansion, and high-temperature stability.

The material can withstand repeated heating and cooling, plus extreme acoustic environments (165dB at launch), for up to 100 Shuttle flights without replacement. Resistance to thermal shock is unmatched. The material can be taken from a 1260°C kiln and immediately immersed in cold water without damage. Surface heat dissipates rapidly and heat transfer from inside is so slow that an uncoated tile can be held barehanded by its edges after removal from the water, and just seconds after its removal from the oven.

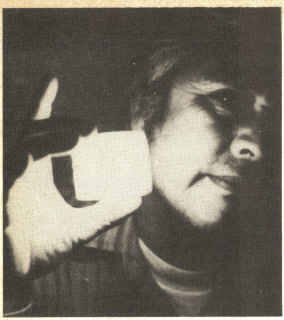
The tile's interior at this time can still be glowing red hot!

Today, the coated and waterproof LI-900 tiles meet all the requirements imposed by the Space Shuttle duty cycle. Translated into mission terms, these requirements are to:

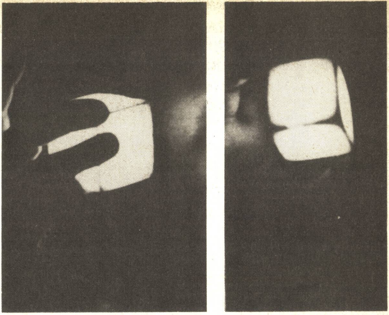
- keep temperatures of the aluminum airframe within structural design limits;
- remain reusable for 100 missions (160-hour minimum turnaround time in between), with no scheduled maintenance;
- meet special heat-resistance needs (in addition to those met in standard as-



Artist's concept of Orbiter re-entry. Nearly 34,000 silica insulation bricks will be used to protect underbelly and upper surfaces from 1260°C temperatures.



Barehanded Lockheed technician holds a glowing cube of LI-900, just seconds after its removal from a 1260°C oven. Surface temperature of cube has been cooled by immersion in water.



These remarkable photographs graphically demonstrate the low thermal conductivity of the LI-900 material. Photos were taken from 10 to 30s after removal of cube from oven.

cent and re-entry trajectories) caused by on-orbit thermal cycling, the plume from the Shuttle's rocket engines, emergency Orbiter abort procedures, and pre-entry heating during "once-around" flights near the upper atmosphere prior to landing;

- provide an insulated surface that offers good aerodynamic smoothness; and
- minimise absorption of rain or humidity (and a resultant weight increase) during periods when the Shuttle is on the ground between missions.

Each tile on the spacecraft will be precisely milled to match the curvature of the Orbiter's surface at the exact point it is to be attached. (The tiles carry code numbers to indicate where they will be placed.)

This reduces overall weight of the insulating system and assures aerodynamic smoothness, but it also means no two of the 34,000 tiles in a shipset are exactly alike. Further complicating assembly, tiny gaps must be left between the tiles to allow air inside to escape in orbit, and those gaps must be uniform to within 0.5mm — a very small margin for error.

All this makes the task of fitting tiles together on the spacecraft's skin somewhat like assembling the world's largest three-dimensional jigsaw puzzle on a surface twice the size of a basketball court.

To simplify milling and assembly chores, Lockheed has developed an "array" concept in which groups of 20 or more tiles will be placed in a frame and locked together in their precise positions for final machining and attachment to the Shuttle.

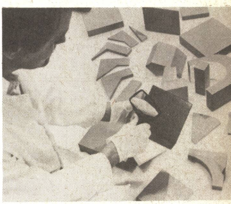
Lockheed's contract with Rockwell International, the prime contractor for the Space Shuttle, includes options for five complete shipsets of tiles. (The first Shuttle, however, will not be insulated until after preliminary, non-orbital flight tests are completed.) These first five spacecraft — excluding spares — will require more than 165,000 individual tiles, enough to consume approximately 198 cubic metres of raw material and cover more than an acre of land.

Although the tiles will be cut into hundreds of unusual and complex shapes for special areas of the Shuttle, most will be either 15cm or 30cm square and differ only in thickness and the curvature of their surfaces.

All will be made from the same silica-based formula, but two different types of coatings will be applied. For the Shuttle's entire underside and some small areas on top where temperatures will reach 650°C to 1260°C, a black reaction-cured glass coating will be used. For areas in the 325°C to 650°C range on sides of the tail section, engines, fuselage, and on top of wings near the front edge, a white silica compound coating will be applied. Shiny alumina oxide will also be added to better reflect the Sun's rays and keep the Shuttle cool in orbit. In addition, reinforced carbon-carbon will be used on the ultra-hot nose and leading edges of the wings, and Nomex felt in regions heated to less than 370°C on cargo bay doors and some upper wing surfaces.

Orbiter 101 — the first Shuttle vehicle which rolled out of Rockwell International's Palmdale, California, plant in September 1976 — has been fitted with only a few LI-900 tiles for test purposes. It will not initially require a complete coat of the material since early flight tests will be conducted at low altitudes and will not involve a fiery atmospheric re-entry.

The second spacecraft (Orbiter 102) will require the full protection of LI-900, however, as it will be the first Shuttle vehicle tested and used on orbit in space. Lockheed began delivering tiles for Orbiter 102 in early 1977. When that job is completed (around mid-1978), the company will start producing tiles for the other four spacecraft (including Orbiter 101) and delivering any spares required to replace tiles damaged during missions. These deliveries will continue into the early 1980s.



Lockheed technician inspects the high-temperature coating applied to one of the LI-900 insulation tiles. The tiles in the background show some of the complex shapes required for certain areas of the Orbiter. Each tile is milled to match the contour of the Orbiter, and no two in a 34,000 set are exactly alike!

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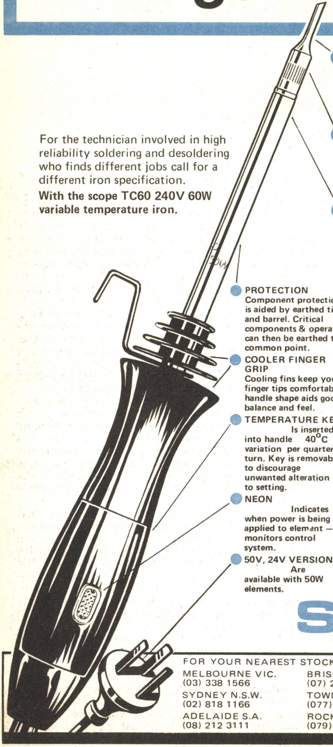

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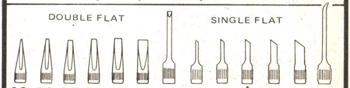

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One of the most brilliant, and perhaps least known, of British scientists was Alan Dower Blumlein, killed tragically in a bomber crash during World War II. A prolific inventor, he gained 128 patents in 15 years and made key contributions to television, sound reproduction and radar... by C. L. BOLTZ

Blumlein: unsung British genius

Setting a commemorative plaque into the wall of a building is traditional in Britain. It is a modern alternative to the once popular statue. Statesmen, artists, scholars and the like have been so recorded, but not many scientists or engineers have been given such treatment. That the Greater London Council has agreed to a plaque for Alan Blumlein is a sign of his revived repute among engineers. Until recently, very few British people had ever heard of him and during his life he received no public honours or membership of societies of high prestige.

So who was he, this unknown genius? First, he was British, born in London in June 1903. His father, a mining engineer, had been born in Alsace but became a naturalized Briton. Alan's mother was the daughter of a Scottish missionary in South Africa.

Alan Dower Blumlein (1903-1942).

Second, he was an engineer and prolific inventor. In 15 years he gained 128 patents, that is, one every six weeks on average. Everyone in Britain sees evidence of at least one of his inventions every day when looking at a television screen. Every ship's navigator watching his radar picture of the coast and ships around him is seeing something to which Blumlein made a key contribution.

He was born in Hampstead, a North-West suburb of London, and he attended in succession two of the small private schools that flourished by the dozen at the time in that neighbourhood. One of these was "progressive", so the boy learned very little and all his life was weak on spelling. At 12, it has been said, he could hardly read but was adept at quadratic equations.

Desperate measures were taken and he was sent to a "cramming" establishment to force-feed him with the basic knowledge needed to enter a public school, where he soon showed his interest in science. He matriculated, that is, he qualified for London University, and went to the City and Guilds College (part of the Imperial College of Science and Technology) on a governors' scholarship. In two years he gained a first class honours degree in electrical technology. He was just 20.

The year was 1923. The word "electronics" had not been coined. Telephone engineering was at an exciting stage, with problems of long-distance transmission, speech quality, interference through cross-talk and so on. Radio engineering existed, with circuit devices being rapidly invented without much fundamental theory of the behaviour of waves and inductive and capacitative circuits at the new "high" frequencies involved. Broadcasting had begun.

It is in this context that Blumlein's first contribution to technology must be seen. His professor was E. Mallett, specialising in telephony. Together they invented a new way of measuring the resistance of a coil at high frequencies. The first paper was so badly written and spelled that it was returned for revision. It was at last published in the "Journal of the Institution of Electrical Engineers" in 1925, and was entitled "A New Method of High Frequency Resistance Measurement". It was original enough to cause considerable discussion and was awarded a premium by the Institution.

At the time it was written, Blumlein was 21 and a demonstrator at his college. Professor Mallett had invented a graphical construction to arrive at a way of measuring the natural frequency of a telephone diaphram. This same geometry was now applied to the measurement of high-frequency resistance.

It is reasonable to assume that Professor Mallet had given the problem to his brightest student, who then did the creative research with the advice and supervision of the professor. The ensuing paper was long and very advanced and showed a mastery of fundamental principles (which word he continued for some years to mis-spell as "principals").

His academic career was soon over. He joined a firm that is best known under its present name, Standard Telephones and Cables. At that time he reeled off, with a collaborator, a series of articles on wireless theory for "Wireless World," which was then, and still is, the most popular British periodical on radio and television.

The substance of the articles showed Blumlein's strong point — he was a

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theory man. His genius lay in the creative way he used his complete understanding of fundamental principles, applying them to practical problems. He was not an innately practical man with apparatus and gadgets, intuitively arriving at a new device. He boasted that he had never made a radio receiver. Therein lay an arrogance of intellect that upset some of his colleagues at first, though it was softened by his sense of humour and generosity of spirit.

His first important invention shows his methods clearly. He needed to measure very small impedances (the equivalent in alternating circuits of resistances in direct-current circuits). The best way of measuring resistance was a circuit called a Wheatstone bridge, wherein a known resistance could be varied to balance the unknown one until no current passed through a measuring instrument, usually a galvanometer.

With alternating current, however, inductance and capacitance are unavoidable however well we construct the devices, and they add or subtract opposition to the current. (The opposition they present is known as reactance.) Moreover, they 'shift' the current wave in relation to the applied voltage wave. These effects became very troublesome at higher frequencies, making it impossible to use an ordinary bridge to measure very small impedances accurately. So Blumlein's invention was a special alternating-current bridge. It was patented provisionally in 1928, when he was 25 years old, and he continued to adapt it for his experiments for years. It was a key invention, No. 323 037 of the British Patent Office.

With such a bridge Blumlein could measure accurately the small capacitance, for example, between two telephone lines near each other. It was a seminal invention and after his death a further unpublished paper on it was found among his effects.

Using the bridge, he solved the problem he had been set — that of cross-talk in telephone loading coils. The company awarded him a bonus of £250 because of his accurate analysis. Between 1927 and 1930 some eight patents on telephony or telegraphy came from him.

By this time he had advanced himself. In March 1929 he joined what was then the Columbia Graphophone Company, now EMI, where he remained for the rest of his life. There he became one of a remarkable team of creative engineers and scientists who contributed a great deal to the reputation and success of the company.

Blumlein's first task was to devise a sound-recording system that would enable EMI to avoid having to pay royalties to Western Electric, which held the main patent for recording. In recording on a disc, a cutting device carves out a "wavy" groove in a spiral from periphery to centre. The "waviness" corresponds to the audio-frequency electrical signals coming to the cutting head. The signals produce vibrations of an iron armature holding the cutting tool, but unfortunately this armature has a natural resonance, and so have many other parts of the mechanism. So without corrective devices the cutting will not correspond faithfully to the electrical signals; some are exaggerated, some reduced.

One way to overcome this difficulty was to make the armature heavy enough to damp out any resonance. Blumlein's technique was to apply fundamental electromagnetic principles and use suitable circuits to modify the resonances. This was at once successful and the company gave him a bonus of £200; they made awards to his collaborators, too, a fact which he acknowledged gracefully. EMI was freed of royalty payments and, as everyone knows, has gone on to become the biggest producer of discs in the world.

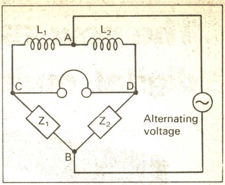
This was by no means all. From March 1930 to March 1933 he secured, sometimes with colleagues, ten patents, one of which was so advanced that it was not given due recognition until 1958. It was Patent No. 394 325 of December 1931.

Its title does not at first show what the substance of the invention was: "Improvements in and relating to Sound-transmission, Sound-recording and Sound-reproducing Systems." What it was really about was the achievement for a listener of three dimensional sense of a sound source, in other words, stereophony, quadraphony and all-round sound, though these words were not used at all. It covered talking pictures, disc-cutting and reproduction, and radio transmission. It looks as if Blumlein intended this to be master patent.

Over a quarter of a century later, in 1958, the Audio Engineering Society devoted one issue of its journal to stereophony and said of Blumlein's patent, "It is of historic importance in the development of stereophony . . . When it is realised that many of the ideas, psychoacoustic, mechanical and electrical, set forth in this document of 1931, are only now gaining wide popular currency, one may reflect on the magnitude of the economic forces which control the viability of inventions."

It was true comment. By the time the recording industry was prepared to put capital into stereo the Blumlein patent had run out. He followed it in 1933 and 1934 with other patents on the same topic. Only recently did the BBC begin to make experimental quadraphonic transmissions.

But his dynamic energy was given a new channel. It was television, in which EMI was very interested. In this he really changed from electrical engineer to electronics engineer, making full use of thermionic-valve circuitry. Inventions leaped from his mind — 17 in 1935 alone, including a few associated with television.



Blumlein's alternating-current bridge resembles the direct-current Wheatstone bridge. When the impedance Z2, a standard used for measurement, is adjusted to balance the unknown impedance Z1, the voltage at C equals that at D and no current flows in the cross-arm; balance is detected by a null in the tone in the headphones. But when measuring small impedances, there is danger of serious error through stray capacitances between parts of the apparatus and from them to earth. To overcome this, L1 and L2 are wound on the same former so that they are inductively coupled. This means that any voltage developed across L1, due to the current flowing in it, is cancelled by a voltage induced in that winding by the current flowing in L2, and vice versa. Therefore, when the bridge is balanced, points A, C and D are all at the same potential. There is then no voltage across the stray capacitances, so no current flows in them to cause error.

The television story is well known. In the 1930s, especially after the brilliant historic pioneering invention in 1933 of the iconoscope by Zworykin of RCA in the USA, EMI was stimulated to a most exciting period of invention. It led to the first real camera and the world's first public TV service by the BBC in 1936. Blumlein was one of the team of outstanding men responsible for this.

RCA would not share its knowledge except at a price, so EMI raced on independently, to such good effect that in 1937 RCA was glad to share its know-how freely with the company. It was Blumlein who went to the USA to negotiate (winning a prize for pistol shooting on the ship going over). The original unrefined iconoscope, which was the basis of a possible TV camera, had weaknesses. Blumlein, together with McGee (later professor at Imperial College), presented a provisional patent specification, No. 446 661, in August 1934, for a TV system (including a camera tube later called the Emitron), less than a year after Zworykin's paper of 1933. It was an achievement of fantastic speed, in a technology that now covers the world.

Meanwhile circuit inventions continued to flow from Blumlein's fertile brain. It has been suggested (by B. J. Benzimra in "Electronics and Power" in 1967) that he was the first to use negative feedback, a technique now common in automation and radio sets. He invented a new valve voltmeter of very high input impedance, important because it did not noticeably affect the operation of the circuits to which it was connected to measure high-frequency voltages. Enthusiastically he seized on the possiblities of new types of thermionic valves for practical devices.

His enthusiasm was also evident in his private life. He learned to fly and gave his bride-to-be their first outing in a two-seater aircraft. He learned to ride a horse and to play golf. He was well off, could afford six weeks' holiday a year, played bridge, and was an ardent theatre-goer.

Then came the war. His acoustic direction-recognition (of his 1931 "stereophony" patent) was applied to detecting submarines. His old remarkable inductive bridge (patent of 1928) was applied as an altimeter for low-flying aircraft, depending on the measurement of the capacitance between aircraft and earth.

EMI was soon caught up in the war effort on radar, or radiolocation as it was then called, in which Britain had an outstanding early lead. Blumlein was in the thick of it. With Dr F. C. Williams (later famous for the first practical computer memory, a modified cathode-ray tube), he invented a way of locking on to a radar reflection so that a fighter aircraft could pursue the target like a guilded missile. This was not patented until 1943.

He continued to get patents throughout 1940 and 1941 and into 1942, dealing with pulse techniques for radar, with oscillatory circuits, and so on, including variations on his old inductive bridge.

One important technique in which he was concerned was code-named H_2S, a subject of many schoolboy jokes. It was a technique whereby a radar beam from an aircraft was swept circularly over the ground beneath, while a cathode-ray tube had a time-base rotating in synchronism. Because of the different intensities of reflection, a "map" was generated of the terrain underneath. It is now a standard technique in ship navigation, using a horizontal beam. The Telecommunications Research Establishment made apparatus. So did EMI, and of course Blumlein was involved. It was intended as an aid to navigation and to precise bombing.

On June 7, 1942 the first equipment was installed in two Halifax bombers for test runs. Flying in one of them were Blumlein and two EMI colleagues. One engine caught fire and the aircraft crashed, killing everyone on board, including Alan Dower Blumlein, who was not quite 39. The loss was catastrophic, and much intense effort was needed to bring H_2S into service. But it was introduced, and shipping losses were reduced by nearly 90 per cent within three months through the ability to find the positions of submarines. Churchill made special mention of it in his account of the war.

After the war a radiolocation convention was held at the Institution of Electrical Engineers in London. In an introduction to circuit techniques Dr Williams added a footnote. "First and foremost the author wishes to express his indebtedness to the late Mr A. D. Blumlein, whose contributions to circuit technique were very great, and from contact with whom the author derived enormous benefit during the early days of the war." It was the only obituary he obtained until the plaque was unveiled at his former home in West London on 1 June, 1977.

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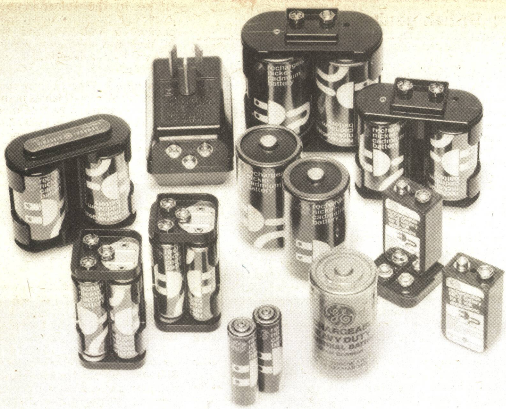

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GENERAL ELECTRIC

Today, says Motorola Inc. of the US, we are looking at the Sun almost as if we had never seen it before. It is the key to mankind's future energy requirements. Motorola has made important advances in solar energy research, and has recently proposed a 500kW solar system using new state-of-the-art solar concentrators.

New solar cell uses mirror system

In recent years we have become vitally concerned about the Earth's energy resources, and rightfully so. Some scientists predict that our oil and coal supplies can last only a few centuries. Others maintain that the resources will be seriously depleted in a few short years.

So where can we turn for a new source of energy? Nuclear power? Hydro? Fossil fuel? Geothermal? All of these are good possibilities, but what about the Sun? Solar energy looks like the most economical power source. The Sun is there, it's free, and astronomers predict it will be in place doing its job for a long time.

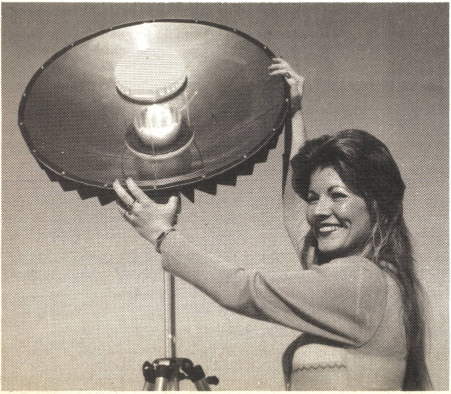
Today we are looking at the Sun almost as though we had never seen it before, because now it has a new and valuable meaning for us. And we are now using the knowledge we have about this hub of our solar system in an attempt to enslave its great power and command it to better our lives.

Like anything else we have ever used for the good of mankind, we must understand it before we attempt to harness it. One physicist said that in some ways we know more about the inside of the Sun than we do about the motion of boiling water. Others say we have made great progress in understanding it, but we still have a long way to go.

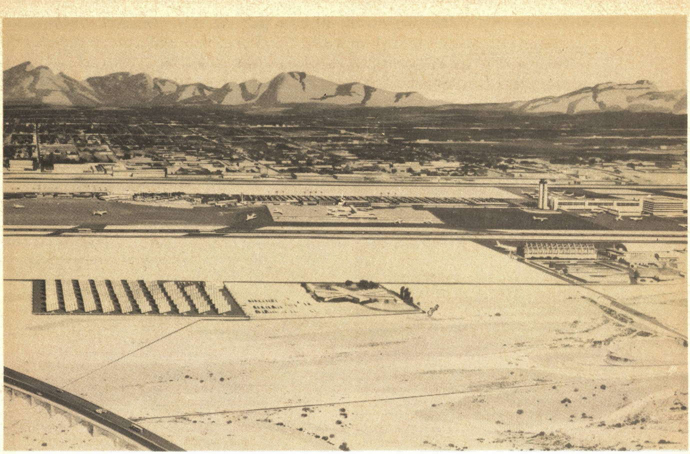
The Sun is the nearest of the stars — a hot, self luminous globe 150 million kilometres from Earth. Light and heat received from the Sun varies by about 7 percent in the course of a year. This is caused by the fact that distance from Earth to the Sun varies by approximately 4.8 million kilometres at different times of the year because of the eccentricity of the Earth's orbit around the Sun. In early January, when the Earth is at perihelion in its orbit, the distance is least. The distance is greatest in the beginning of July when the Earth is at aphelion.

The Sun contains 300,000 times as much material as the Earth, and at its core the Sun's temperature is in the order of 15 million degrees C. (The temperature of an electric furnace is less than 3000 degrees C). But the 15 million degree temperature is not blasted at the Earth. If the entire heat of the Sun's core bombarded the Earth, in the words of one renowned astronomer, "the rocks would bubble", and our planet would melt.

The heat at the Sun's centre is so intense it is in the form of X-rays. However, as it travels outward to the Sun's surface, the temperature is



Motorola's new solar concentrator module is capable of producing 25 watts using a 69mm cell. A second generation concentrator, now under development, will use a 97mm cell and produce 39 watts.



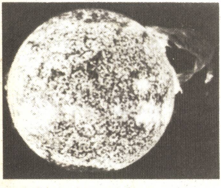
Artist's concept of the proposed 500kW solar power system at Phoenix airport.

reduced as the heat passes through a number of solar layers. Finally at the surface of the Sun, the temperature is approximately 6000 degrees C.

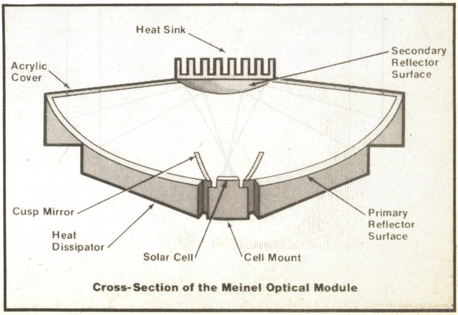
The most noted scientists predict that the Sun's supply of hydrogen will last about 5000 million years. However, after about 2000 million years it will become much too warm for the comfort of Earth inhabitants. Solar theoreticians believe the energy of the Sun is created by hydrogen being converted into helium, and as more and more hydrogen becomes helium, the Sun will become hotter and hotter. When the Sun has consumed about one third of its present supply of hydrogen, the Earth's climate will start to become too hot for any form of life. Later the Sun will become so hot our oceans will boil and all life as we know it will cease.

A horrifying thought, but we have more than enough time to utilize the Sun's power and delve more into what scientists today call our solar-terrestrial relations.

Research into solar power systems is already at an advanced stage at Motorola Inc, Arizona, USA. One recent achievement has been the development of a state-of-the-art photovoltaic concentrator module. This was developed by Motorola specialists at the Government Electronics Division in Scottsdale working in co-operation with Dr. Aden Meinel of Arizona Scientific Research (ASR), a noted authority on optical systems.



A Skylab 4 photo of the Sun shows a spectacular solar flare spanning more than 59,000 kilometres across the solar surface.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Secondary Reflector Surface
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Solar Cell
Cell Mount
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Cross-Section of the Meinel Optical Module

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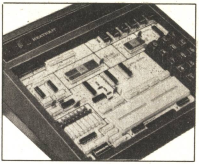

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New solar cell . . .

The module is a Cassegrain-type optical concentrator that illuminates a circular target area. A cusp reflector allows wide off-axis performance at a high concentration ratio.

A segmented, 7.5cm circular concentrating solar cell is mounted at the module's target area. The cell segments are series connected on a cell mount that also serves as a heat dissipator. Fins on the rear of the primary reflector allow passive cooling of the cell and also add to the structural integrity of the concentrator.

Engineering feasibility tests in the Government Electronics Division Solar Energy Laboratory on a module featuring a 69mm cell disclosed a module output power of 25 watts with a solar concentration ratio on the cell of 40x. Now under development is a second generation concentrator with a 97mm cell to produce 39 watts at 27°C with a 70x solar concentration ratio.

The production version of the module is 760mm in diameter and 280mm deep. A curved aluminium surface polished to a highly specular reflectance serves as the primary reflector, and the secondary reflector is also a highly polished aluminium surface. The front cover is acrylic which offers good optical properties and resistance to weathering to protect the reflective surfaces and the solar cell.

Mounted in arrays to form a complete system, the Motorola photovoltaic concentrator modules could easily provide adequate power for apartment complexes, industrial facilities, shopping centres, schools, and even small cities.

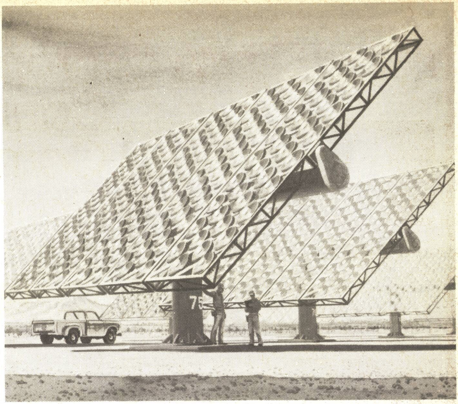
A system comprised of Motorola photovoltaic concentrators would be ideal to power a remote location facility where the user does not have access to conventional power sources.

As a positive demonstration of the practicality of the Motorola Meinel module the company teamed with Arizona Public Service (APS), the Arizona Solar Energy Research Commission, and the City of Phoenix to propose to the Department of Energy a 500kW photovoltaic concentrator system for installation at the Phoenix Sky Harbor International Airport.

Under the proposal, the City of Phoenix donates a 5-hectare site at the airport; the State of Arizona Solar Energy Research Commission endorses and monetarily supports the project for parallel studies; APS, a prominent utility in the field of energy research and development, will build, operate and manage the experimental solar plant; and the Motorola Government Electronics Division will provide 14,250 concentrators mounted on 75 arrays. Motorola also will provide a master control and data acquisition system that controls the system output power, the array steering and system data acquisition and displays.

The solar plant would be designed as a solar powered generating system tied directly to a utility power grid in its primary mode and connected directly to an isolated load centre in the new airport terminal as its alternate mode. Utility dispatch can treat the output as any other generating plant.

If approved by the Department of Energy, the solar plant will be in operation by late 1980.



Artist's concept of Motorola's new concentrator modules mounted in arrays. View shows how modules would look for proposed Phoenix airport system.

Adapted from material supplied by Motorola Inc., Scottsdale, Arizona, USA.

Advances in solar cell design

The Motorola Semiconductor Group, sister division of the Government Electronics Division and located a few kilometres away in Phoenix, has developed what it claims is the most advanced solar photovoltaic cell available.

The state-of-the-art cell incorporates design, interconnection and encapsulation techniques to tap and transform the Sun's radiant energy at the highest levels of performance.

Resembling a densely packed field of microscopic pyramids, the uniquely texture-etched surface of the solar cell offers a 99% absorption rate, said to be unequalled elsewhere in the solar cell industry.

The Motorola solar cells are sealed in environment-resistant modules, or "flat plates", completely encased in clear silicone within a peripherally-sealed glass and stainless steel case.

Solar module arrays and storage systems can be sized to meet almost any requirement. A specially designed Motorola computer program determines optimum tilt angle of the solar array to obtain maximum exposure to sunlight at that location, number of modules required, and the necessary battery storage capacity. The module system provides continuous operation at low cost, even during prolonged periods of adverse weather conditions.

Forum

Conducted by Neville Williams

NOISE: HAVE YOU GONE DEAF YET?

I had really thought that we had said enough about loud noise, loud music and its potential effect on our hearing; but the subject still keeps coming up, both locally and overseas. There's even some reason to hope that our awareness of noise is catching up with our ever increasing ability to create it.

I first raised the matter of excessive sound levels in the November issue, last year, in the context of entertainment situations. I pointed out that excessive levels are not necessary, that they cause positive distress to some people in the audience, and that they add to the risk of cumulative hearing loss.

In general terms, the same remarks apply to any situation in which people are subjected to loud noise for prolonged periods.

Support for the article was virtually unanimous. Not one person came out on the side of over-loud music and not one person questioned the hazard to hearing of prolonged exposure to excessive sound levels.

But I wonder how many backed up their strongly held opinions by practical measures such as:

- Avoiding high noise situations, where possible, or . . .
- Protesting to management in a courteous way, and/or
- Wearing earmuffs of plugs of absorbent fibres when using noisy industrial or domestic equipment.

I fear that, while agreeing that such measures are wise, few of us bother to put them into effect. We prefer to put up with the noise and assume that, mysteriously, we will somehow escape its penalty.

Quite deliberately, the heading above is directed at those of us who may be inclined to think and act in this way. It is not intended as a gibe at those who may have a hearing impairment through no fault of their own.

Recently, I was chatting with a young man who, despite a strong interest in matters electronic, had accepted apprenticeship to a boilermaker. I immediately thought of a number of retired boilermakers I had met, most of them suffering from a drastic hearing loss.

Was this young man aware of the problem and the way in which it might compromise his enjoyment of hifi sound within a few years?

Yes he'd heard about it!

Was he taking positive precautions to protect his hearing right from the outset?

No, not really . . . but he'd think about it some time!

Nor are boilermakers the only potential victims of noise.

A few weeks ago, I happened to be in an enclosed service area where a carpenter was erecting a series of partitions. The portable rotary saw he was using was a beauty, to judge by the way it was ripping through large, heavy sheets of particle board. But the noise level inside the enclosed space was incredible and, as far as I could see, he — and everyone else working in the area — was simply putting up with it!

For the other workers, it would have been a short-term situation — unpleasant but temporary. For the carpenter and his ears, the saw and the noise would be a daily routine.

NOISE LEVEL TABLE

INJURIOUS RANGE:	
140dB	Jet engine at 25m
130dB	Rivet gun Pain threshold
120dB	Propeller airliner, 50m
DANGER ZONE:	
110dB	Pneumatic rock drill
100dB	Metalworking shop
90dB	Heavy transport truck
SAFE RANGE:	
80dB	Busy street
70dB	Private car
60dB	Ordinary conversation, 1m
50dB	Low conversation, 1m
40dB	Soft music
30dB	Whisper at 1m
20dB	Quiet dwelling
10dB	Rustling leaf
0dB	Threshold of hearing.

Maybe we should take a lesson from our staff member, Leo Simpson, who obviously wants to preserve his ability to listen to, and comment on, hifi equipment. Leo makes it a flat rule never to use his petrol mower, or to use noisy power tools in the house, without cotton wool or earmuffs, or both! Thus far, his precautions have paid off handsomely.

Which brings me to a letter from a Queensland reader:

Dear Mr Williams,

During the 29 years I have been a reader of E.A. and R.T. & H. I cannot remember having seen an article dealing with the construction of a hearing aid, a device that has now become necessary to me after years of exposure to high levels of noise.

Working as an electrical fitter, I spent the fifteen years prior to my retirement, on the installation of, and later, the maintenance of an A.E.G. automatic rail welding machine.

While the noise level generated by the machine alone was quite low, the same cannot be said about the process of removing the surplus metal around the actual weld.

This was accomplished by the use of compressed air operated chisels, which created a noise level very close to the threshold of feeling, with a resultant legacy of headaches and other allied symptoms, a combination which made the prospect of retirement most attractive.

I have a high quality amplifying system which uses among other items, the Hybrid Preamplifier described in E.A. February, 1968, a circumstance which prompted this letter.

You would be conferring a great favour on me, and I am sure, many more of your readers were a hearing aid design featured in an early issue. In conclusion may I offer my thanks for the many informative articles that have appeared in E.A. over the years.

G.McA (White Bay)

First, we would acknowledge his words of appreciation, and commiserate with him on his hearing problem — the story of the retired boilermakers all over again! But what about hearing aids and, in particular, hearing aids for home construction?

It is true that we have not described a build-it-yourself hearing aid for as many years as I can remember, but it is not because we have simply or carelessly ignored the needs of afflicted readers. The subject has been mentioned at various times in the past but our indexing system is not sufficiently detailed to reveal when and where.

No matter: it may be timely to outline the position again, in response to the above letter.

At first encounter, it may seem that deafness is simply a loss of sensitivity in the hearing mechanism and that it could be made good by using a hearing aid which contributed the equivalent number of decibels of acoustic gain. But it is not as simple as that; not by a long way.

- Deafness may be the end result of a number of physiological conditions, which can occurr separately or together. It is desirable to identify the reason(s) in order to specify the most suitable kind of hearing aid and, in particular, the most suitable kind of output transducer.
- Some of the conditions leading to deafness require specialist medical attention, as distinct from a mere effort to compensate the hearing loss.
- Loss of sensitivity at the threshold of hearing may be much greater than at high levels. In effect, the sufferer has a restricted dynamic range. Their hearing aid should therefore include some form of automatic level compression to operate within the narrow dynamic window.

CONCERNED ABOUT HEARING IMPAIRMENT, the Brooklyn Centre for the Performing Arts at Brooklyn College has set a maximum permissible sound level for concerts. Before performing, electronically amplified musicians must agree not to exceed 105dB, as measured at a distance of 10ft from any loudspeaker, for a period of more than one minute. If they do, the Centre reserves the right to "pull the plug" — and to fine the musicians $500 into the bargain. The Centre's restriction is said to be the first such imposed in the USA (from "Stereo Review").

- Hearing loss tends to increase with rising frequency and a seemingly obvious course would be to complement this in the hearing aid to produce a "flat", wide-range subjective response. However, it usually proves desirable to deliberately attenuate frequencies outside the range 300Hz to 3000Hz, to minimise noise and redundant acoustic energy, simply to obtain adequate speech articulation.
- There may be pronounced differences between the two ears, necessitating a decision as to which ear is most amenable to assistance.
- Where the gain of the hearing aid has to be high, to counter a large hearing loss, acoustic feedback between the earpiece and the microphone becomes a serious problem. It is almost essential for the earplug to be moulded to the individual ear to achieve an effective acoustic seal. A mass produced "standard" fitting will seldom suffice.

Specialists in the hearing aid field employ a variety of instruments and a variety of examination techniques to determine the true state of a patient's hearing, as often as not despite — rather than because of — the patient's responses. Armed with this information, they are in a position to advise on the type of transducer, the type of hearing aid and the way in which its parameters should be set up.

Hopefully, if they have the appropriate chairside manner, they will also be able to forewarn the patient about likely reactions and problems and thus forestall the possible short-term reaction that "I've wasted my money ... I'd be better off staying deaf!"

Behind this last reaction is the fact that most of us are surrounded at times by distracting, if not dangerous noise but we learn to ignore it, or to listen to wanted sounds through it, largely due to our two-ear "stereo" capability.

A person who has gone slowly deaf gradually loses these skills, communicating in whatever way they can in a world of muted noise.

Suddenly, per medium of a hearing aid, they are thrust back into the real environment, made all the more daunting because they are hearing the noise through an imperfect mono medium. They feel as startled, as embarrassed and as unsure of themselves as an accident victim who has to learn to walk again with one leg in a caliper — a simile that I can voice with no little conviction!

Against that background, we question the wisdom of promulgating any kind of "average" design, aimed at meeting the "average impairment. Undoubtedly it would suit some people but we are more concerned about the many others who could not only be frustrated but positively disadvantaged by an inept approach to what is a deeply personal problem.

There is, of course, the practical aspect of building a suitably small hearing aid from available parts. The days have gone when people were prepared to hang little boxes around their neck and I just cannot see non-specialist designers, non-specialist suppliers and non-specialist constructors coping with the sub-miniature assemblies involved in a modern hearing aid.

That is why we have not attempted such a project for as long as I can remember and it's almost certainly the reason why most other magazines appear to follow the same policy.

Not for one moment would I suggest that the specialist hearing aid companies do not enjoy their exclusivity; or even take advantage of it. But I guess the same is true of those concerns that provide spectacles and false teeth!

What of our original correspondent and his problems?

If he needs a hearing aid for social interaction, I guess that he will have to follow the usual course: visit a specialist

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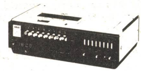

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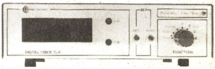

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FORUM — Have you gone deaf yet?

in the field and have a hearing aid prescribed and fitted. Almost certainly it will be optimised for speech, because that is usually the area of greatest need.

As for his hifi listening, I wonder whether he has exhausted the most obvious course: to listen through headphones? I have in mind one pair that I saw some time back, with a control box in the line cord, giving a 3-step tone control effect and a separate level control for each ear. Something like that would look after frequency balance and left-right balance and preserve the stereo effect. The main problem I can forsee would be with dynamic range.

It occurs to me that, since our correspondent is using a 1968 preamplifier, his main amplifier may not have provision for connecting headphones. In that case, he could build up our "Universal Headphone Unit" which was described, most recently, in "Projects and Circuits No. 2," available from our office for $3.60 posted. It includes level and balance controls intended for users with impaired hearing.

Just before sending this to the printer, I passed the M/S to a technical acquaintance who has quite a lot of hearing problems; they have involved resource to earphones, headphones, hearing aids, operations and what have you. His overall reaction is that once the hearing starts to go, the sufferer is almost certainly condemned to accepting compromises, which are likely to become progressively more severe.

If one loses frequency response and/or dynamic range and/or binaural perception, there is simply no way known at present by which the sufferer can adequately sense or appreciate a full-range omni-directional sound field, no matter how anxious he may be to do so.

As my acquaintance remarked: "Ears are not like eyes. The average citizen can be fitted with spectacles and, for all practical purposes, enjoy normal vision until late in life. It doesn't work that way with ears, or anything he can fit to them!"

I wonder what the experience of other readers has been?

To change the subject, I was intrigued by an item in the English magazine "New Scientist", as per the accompanying panel.

I had to read it several times before deciding what they were really getting at, as distinct from what, at first glance, seemed like multiple silly statements. The line of reasoning, I believe, runs as follows:

(1) In designing a high fidelity loudspeaker system, there is an advantage in using a bass driver with the lowest possible system resonance — preferably below the normal audio spectrum.

(2) To isolate sound from the front and rear of the cone it is necessary to mount the driver in an enclosure. However, this tends to compromise the first proposition because the "springiness" of the trapped air, acting on the cone, raises its effective resonant frequency.

(3) If a second driver is mounted on the rear of the cabinet and so driven that it will relieve the internal pressure at the same instant that the front driver is trying to increase it (and vice versa) the loading effect of the trapped air on the front speaker will be eliminated. It will be in an enclosure but will not suffer any increase in cone resonance.

So far so good, but they have failed to mention one rather vital point:

As far as air pressure in the listening room is concerned, the two drivers will be out of phase, with the rear speaker seeking to "evacuate" the room at the instant when the front speaker is trying to "pressurise" it, and vice versa. In other words, unwanted radiation from the rear of the front driver will simply be replaced by unwanted radiation from the exposed surface of the rear driver. Cancellation will take place, thereby defeating the original purpose of the enclosure.

In fact, it would seem that much the same result would be achieved by simply omitting the rear driver and substituting an acoustically transparent grille for the back of the box!

How the Isobaric speaker works:

A recent British patent (BP) 1 500 711) reveals details of the Scottish Linn Isobaric loudspeaker. Until now the working principle of the loudspeaker has been unpublished. The object is to mount a loudspeaker driver so that its natural resonance is sufficiently low to be inaudible and there is no cancellation between sound from the front and rear of the cone. Normally these two requirements conflict: to prevent cancellation the driver must be mounted, in a cabinet which in turn raises its resonance to an audible frequency.

The Linn patent names Ivor Tiefenbrun as inventor and proposes that two rather than one drivers should be mounted, one behind the other with a sealed chamber of air in between. The two drivers are fed with a similar audio signal and move in ganged fashion. The trapped air thus retains a constant pressure, that is the air chamber is isobaric, and the front driver behaves as if mounted in cabinet. In this way, it is claimed, the best of both worlds is obtained.

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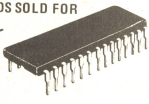

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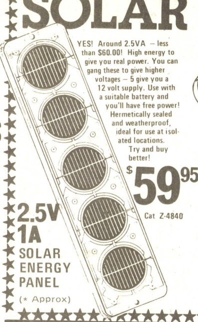

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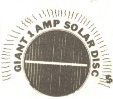

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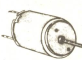

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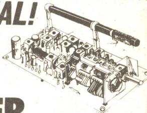

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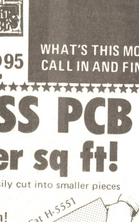
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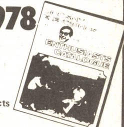

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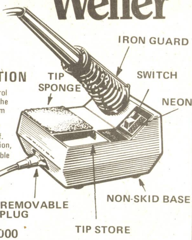

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3 FOR $2.50
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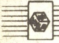

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We won't have them in stock until late August, but they're well worth waiting for, especially when you consider the incredibly low price . . . **$12.50!**

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4.433619MHz PAL sub-carrier frequency crystal. **Cat K-6026 .. .. $4.75**

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Same style as previous kit, but new circuitry means it is easier to build, set up and is more sensitive. Basic counter is 40MHz – by adding a single 95H90 IC the range is extended to 200MHz.

Complete kit for 40MHz, inc. instructions.	**Cat K-3437**	**$99.50**
95H90 IC to extend range to 200MHz	**Cat Z-5360**	**$16.50**
SEPARATE PARTS:		
PC Boards (set of two top quality boards)	Cat H-8346	$8.50
MC-10116L IC (triple differential amplifier)	Cat Z-5415	$1.95
MM-5369M IC (oscillator – divider)	Cat Z-5781	$3.50
74C926 IC (4 digit counter)	Cat Z-5414	$12.00
3.579545MHz crystal (new low price!)	Cat K-6031	$3.00
LT-303 7 segment display	Cat Z-4103	$1.90

All other components are normal stock lines at all of our stores.

PHOTO TACHOMETER (See August E.A.)
Although we do not produce a full kit for this project, all parts are normal stock lines at all of our stores.

PCB (only)	Cat H-8352	$1.80
FPT100 phototransistor	Cat Z-1950	$2.00

UTILITY TIMER (See August E.A.)
Again, not produced as a special kit – all parts are normal stock lines.

PCB (only)	Cat H-8345	$3.50
6V Buzzer	Cat L-7009	$1.75
Zippy box case	Cat H-2753	$1.95

NEW 10 GAME TV GAME KIT (See July E.A.)

Complete kit, including instructions	**Cat K-3491**	**$49.50**
SEPARATE PARTS:		
PCB (only)	Cat H-8344	$3.95
Fully built RF modulator	Cat K-6040	$3.00
Fully built audio modulator	Cat K-6042	$4.50
AY-3-8600 IC	Cat Z-6852	$15.00

TRANSISTOR TESTER (See July E.A.)

Complete kit, including instructions	**Cat K-3052**	**$17.90**
SEPARATE PARTS:		
PCB (only)	Cat H-8350	$1.95
1mA panel meter	Cat Q-2010	$7.90

AUDIO OSCILLATOR KIT (See June E.A.)

Complete kit, including instructions	**Cat K-3469**	**$25.00**
SEPARATE PARTS:		
PCB (only)	Cat H-8614	$3.65

VK POWERMATE (Short form) See May E.A.

Electronics, but no metalwork, terminals.	**Cat K-3449**	**$32.00**
SEPARATE PARTS:		
PCB (only)	Cat H-8342	$2.00
Special 5600uF/40V electrolytics	Cat R-4570	$3.90
Power transformer	Cat M-2000	$17.32

R-C-L BRIDGE (See March E.A.)

Complete, with printed un-punched panel.	**Cat K-3468**	**$34.50**
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PCB (only)	Cat H-8339	$2.50

SIMPLE 12V TO 22V CONVERTER (See E.T.I July)
Not produced as a kit, but all parts are available as normal stock lines except the PC boards. You can make your own PC boards using the Scotchcal process & resist – see our adverts last month for details.

UP/DOWN PRESETTABLE COUNTER (See E.T.I. July)
Not a full kit. Special parts:

ICM 7212A IC counter	Cat Z-5416	$16.00
Special PC boards to suit the Dick Smith Z-4103 7 segment displays:		
PC boards A & B	Cat H-8617	$4.95
7 segment displays	Cat Z-4103	$1.90

STUNT MOTORCYCLE TV GAME (See E.T.I. June)

Full kit, including instructions	**Cat K-3474**	**$29.50**
SEPARATE PARTS:		
PCB (only)	Cat H-8615	$3.85
Fully built RF modulator	Cat K-6040	$3.00
AY-3-8760 IC	Cat Z-6854	$19.50
3.58MHz crystal (new low price)	Cat K-6031	$3.00

AUDIO OSCILLATOR (See May E.T.I.)
Not produced as a kit. Make your own front panel with Scotchcal – see our adverts last month for details. Most parts for this are normal stock lines.

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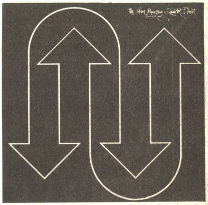
Hi Fi News

THE STORY BEHIND AUSTRALIA'S FIRST DIRECT-TO-DISC STEREO

Last month, we discussed the first direct-cut LP-stereo disc to be submitted to us for review. This month, we follow up with the review and background story of what we believe is the first such disc to have been released in Australia — a performance by the Steve Murphy Quartet.


The Steve Murphy Quartet Direct

Externally, the jacket design is simple and predominantly black. It opens out to reveal the notes and colour illustrations.

by NEVILLE WILLIAMS

In suggesting any kind of a "first" in a local direct-cut disc, it is important to qualify it as "LP-stereo", because any number of direct-cut discs were engineered in Australia during the 78 rpm era; at the time, it was the only way to make them!

The artists and/or musicians would assemble in the studio or auditorium and rehearse from three to five minutes of the program to be recorded. Meanwhile, the technical staff would be poring over the score and notations, checking levels and so on. Then there would be a sudden hush, the cutter would be lowered on to the "wax" master and, at a given signal, the performance would proceed.

Hopefully, the performance and the recording would be acceptable to all concerned, at which time attention would turn to the material for the next side. If the performance or recording wasn't acceptable, however, the whole thing would have to be done again, and maybe again!

Needless to say, it didn't take too many "fluffs" for tempers to grow very short. And they became even shorter when the early LPs demanded much longer takes.

In point of fact, it is probably true to say that modern long playing albums would never have become truly viable had it not been for the emergence of tape recording and the feasibility of using tape masters.

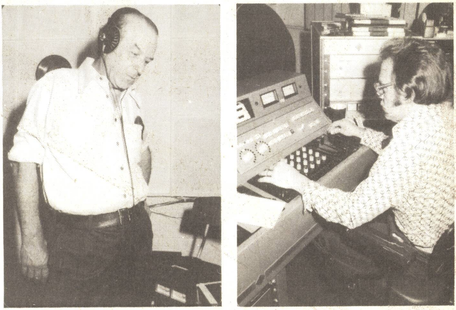
Only then did it become practical to select, edit and assemble — economically — program "takes" of 15 to 30 minutes duration, prior to recording them on disc. The job could be done by producers and engineers, without pressure, long after the performers had dispersed.

No less important, the system made it possible to vary the balance and dynamics of the program during transfer to disc — along with the groove pitch — either manually or automatically. If thought desirable, it was even possible to add synthetic ambience or echo.

However, purists have always tended to question the approach on the grounds that the intermediate processes must add a quota of noise, distortion and phase discrepancy no matter how small, and must move the end result one (or more) steps further away from the original. They even question the validity of assembling from "doctored" segments a simulated performance that never actually occurred!

To such people, the correct approach is to get back to basics: good original acoustics, the simplest practicable microphone array, a minimum of "console" electronics and then straight into the disc cutter.

Such is the interest along these lines that a number of small specialist groups around the world have released direct cut discs and, here in Australia, a group



At left, Harry Mauger, Astor Pressing Plant Manager, listens to the audio mix of the disc "The Steve Murphy Quartet Direct". At right, Frank Hulbert, Cutting Engineer at the Melbourne Astor Plant keeps a watchful eye on the stereo balance being fed to the SX74 cutting head.

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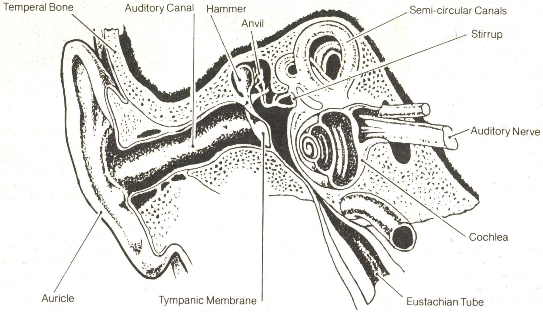

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HA104/78

of enthusiasts in Melbourne decided recently to "give it a go". Included in the group are people with whom we have had association in past years: Bill Hawtin, one of the principals of the East Recording Company; Max Hull, an amateur and audio man from way back; Harry Mauger, technical manager of the Astor record factory in Melbourne.

For all three, the motivation was simply to extend an interest originally stirred by direct cut pressings from overseas. No one expected to make much money out of it, as witnessed by the fact that it will be sold at well below the cost of any comparable disc currently available in this country.

Harry Mauger did not even profess to be convinced that direct cutting was an automatic panacea. He is inclined to blame many of the complaints about tape-sourced recordings on the idea that modern facilities have tended to make recordists lazy. If I can paraphrase his remarks: "They don't study mic placement or acoustics as they should. They poke a microphone down each performer's throat, stick them all on separate tracks and then try to sort them out later. No wonder they get into a muddle!"

However, having decided to proceed, the enthusiastic trio discovered the practical problems: firstly, where could such a recording be made?

There are any number of recording studios in Australia but most of them work into lines, links or tape recorders, thereby defeating the concept of a direct feed to the cutting amplifier.

Likewise, there is a fair array of cutting lathes, most of them in factory-laboratory situations, and living on a steady diet of tape!

It was finally decided to make the recording in the Astor Records factory complex, within easy reach of their Neumann cutting lathe — a modified model ZT32S using a SX74 helium-cooled cutting head and an AM-32B-VA-32E solid state drive system.

Initial plans to record in the evening, using an open area of the factory, were frustrated when the management found it necessary to set up a night shift. Ultimately, an auditioning room had to be used, barely large enough for a small instrumental group. Even so, a fair amount of planning was necessary to accommodate the setting up, the rehearsals and the actual recording sessions, without disrupting the routines of a large factory complex.

Finding a musical group was another problem. They had to be available and interested, and able to arrange, rehearse and perform two 15 plus-minute program segments, without fluffs and with no more than the usual brief pauses between the tracks of an LP album. With the cutter running continuously, there is no time to relax and reorganise between numbers.

Production engineers Max Hull (left) and Bill Hawtin (right) watch the first test cut being made. The lathe is the Astor Record Company's Neumann ZT32S, fitted with an SX74 cutting head.

Finally, the Steve Murphy Quartet agreed to co-operate in the enterprise: Steve Murphy on Hammond organ, Jack Gay on electric guitar, George Aylor on drums and Maurie Sheldon on electric bass.

While the music from such a group might be condemned as "second hand" (it emerges from loudspeakers) the Hammond organ was the only instrument so affected. Splits were taken direct from the guitar and bass so that, although the players heard their own music in the normal way, the signal to the console came directly from the source instruments. The sound from the organ and drums was picked up by multiple Sennheiser MD441 and MD421 microphones, connecting back to a Sony MX20 8-channel mixer, then fed on to the Neumann lathe, manned by recording engineer Frank Hulbert.

And just as well Frank had plenty of experience behind him: over 18,000 acetates cut at the Astor plant since he came from the UK 22 years ago! With no tape to preview, he had to rely on the instrumentalists and on the panel mixer to duplicate the dynamics that had been observed during rehearsals. Nor could he use the automatic groove spacing facility, which relies on reading the signal off tape in advance of the main signal head.

Perhaps not surprisingly, the masters from the first recording session failed to come up to expectations. In the effort not to overmodulate the grooves, the general level had been kept too low, thereby prejudicing the signal/noise ratio. So the whole effort had to be repeated to produce what turned out, this time, to be two excellent masters.

Carefully processed through to the stamper stage, five test pressings were produced to allow the sound to be evaluated under domestic listening conditions. They were voted as being eminently satisfactory and suitable for market release.

Although produced in the Astor Record factory, the release pressings are not being sold under the Astor label. They are being distributed by Jazznote Records, PO Box 111 Kew, Victoria 3101, and also (we understand) through the World Record Club.

And, of course, the content is free-wheeling jazz by the group mentioned earlier with the track titles: Blue Moon — Bunny — St Thomas — There Will Never Be Another You — How High The Moon — Doin' My Thing — Gettin' It Together.

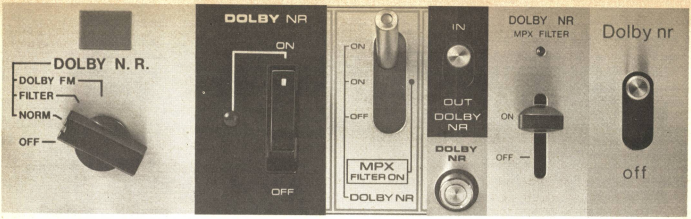
And the quality?

After all that, it had better be good; and it is good, although one faces the anomaly that the Hammond organ is making its contribution through an amplifier and speaker system, anyway. Even so, the impression is of very clean sound, biting transients and really fundamental bass. And no noise background.

Better than a tape sourced disc?

Let's be realistic. If the characteristics of a recording are such that it does not intrude to any apparent degree on the program, it is immaterial how it was produced. Once the technical smog has cleared, your enjoyment of that recording will depend purely on your rapport with program content.

I cannot therefore say whether you will enjoy "The Steve Murphy Quartet Direct" (Jazznote JNLP020). What I can assure you is that it's a good recording, well able to fill a second role — that of a technical conversation piece.



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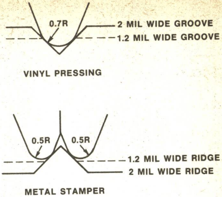
STANTON BI-POINTED STYLUS PLAYS MATRICES AND STAMPERS

Responding to an intriguing challenge, engineers of Stanton Magnetic Inc have evolved a solution to a long-standing problem for disc record manufacturers. They have made it possible for them to play back metal matrices and stampers and to identify audible faults before getting involved in further costly production steps.



Top: illustrating a conventional 0.7ml stylus resting in a groove and (bottom) a twin 0.5ml stylus astride a ridge.

Unlike their counterparts in the magnetic tape area, disc recording engineers have traditionally faced the frustration of not being able to check back immediately on the result of their efforts.

The problem was especially acute in the 78 rpm era when the original recording was made on so-called "wax" masters, which were much too soft to be played back by any then feasible pickup. The recording engineer could only inspect the groove visually and pronounce it okay, before releasing the performers. The actual audible evaluation had to await the production processes, at least to the "mother" stage, when the recording could conceivably be played back.

It is less of a problem area, nowadays, for at least two reasons: Firstly, the vast majority of master recordings are made on tape; if a master disc turns out to be faulty, it is not all that difficult to cut a new one. Secondly, modern "lacquer" masters are much more durable and can be checked immediately with a lightweight pickup, if thought necessary.

However, there is still a problem at the stamper stage, in that imperfections may occur as a result of dust particles or flaws in the plating process. It is normal to inspect stampers visually for such faults but it is a tedious and rather inconclusive procedure. There is always the risk that, having gone to all the trouble to set up a stamper in the press, audible faults will show up in the finished discs.

Curiously, the Stanton Company's answer to such problems emerged from work which did not even have the problems in view. Stanton are not even in the business of making records.

In a paper presented before the Audio Engineering Society (Los Angeles, 1977, preprint 1272 — G1) George Alexandrovich of Stanton Magnetic Inc. explained that it all started when his company purchased an electron-beam microscope with the object of seeing for themselves what went on in the recording and playback process. It was an open-ended investment in R&D.

One of the first things they saw was a damaged ridge in a metal stamper. They realised, of course, that the damaged ridge would become a damaged groove in any disc pressed from it, but that was all. A record manufacturer would presumably discard such a stamper as a routine matter of quality control; nothing to it!

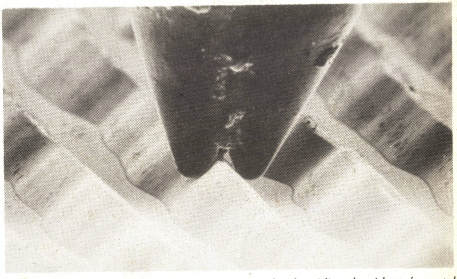
However, during a visit to All Disc Records in Roselle, N. J. Alexandrovitch learned from factory manager Steve Ladden that flaws in stampers posed a very real problem. Indeed, his company were searching for a more effective way of monitoring stamper quality. The ideal would be to be able to play them directly but this appeared to be impractical. Stampers were really a "negative" in metal of the finished disc, and how could one possibly play an undulating ridge instead of a modulated groove?

Thoroughly intrigued by the challenge, Stanton engineers spelled out for themselves what would be needed:

- A saddle-shaped stylus that would sit astride the ridge, clearing the peak (equivalent to the bottom of the groove) but supported by the sloping sides (equivalent to the groove walls).
- A turntable that would rotate in the opposite direction from normal, i.e. anti-clockwise.
- A tracking arm that would be a mirror image of the normal tracking arm.
- Some hold-down provision (eg, magnetic) to clamp the matrix or stamper to the turntable, without interfering with the normal behaviour of the cartridge poised above the stamper.

Problems to do with the turntable and pickup were not insignificant but they required fairly obvious mechanical solutions. The design and behaviour of the saddle stylus represented the area of greatest uncertainty.

It was earlier decided that the projected BPS (Bi-Pointed Stylus) should be made to fit cartridges such as the Stanton 681EEE, being familiar to, and widely used by, recording engineers. It would also simplify comparisons



Photograph of the Stanton Magnetics bi-pointed stylus riding the ridge of a metal stamper. Note that there is ample clearance between adjacent ridges. Stanton give no clue as to how the stylus is produced but our bet is that the tips are polished separately, then ground on one face and cemented together.

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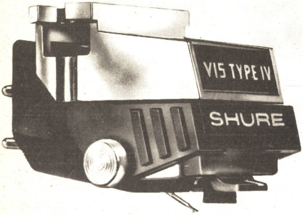

The creation of the new V15 Type IV is a tour de force in innovative engineering. The challenge was to design a cartridge that would transcend all existing cartridges in musical transparency, technical excellence, and uniformity. The unprecedented research and design disciplines that were brought to bear on this challenge over a period of several years have resulted in an altogether new pickup system that exceeds previous performance levels by a significant degree—not merely in one parameter, but in totality.

In fact, this pickup system has prevailed simultaneously over several extremely difficult music re-creation problems which, until now, have defied practical solutions. Most of all, this is an eminently musical cartridge which is a delight to the critical ear, regardless of program material or the rigorous demands of today's most technically advanced recordings.

THE V15 TYPE IV OFFERS:

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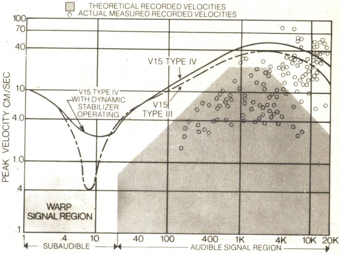

*Cartridge-tone arm system trackability as mounted in SME 3009 tone arm at 1 gram tracking force.

- Dynamically stabilized tracking overcomes record-warp caused problems, such as fluctuating tracking force, varying tracking angle and wow.
- Electrostatic neutralization of the record surface minimizes three separate problems: static discharge; electrostatic attraction of the cartridge to the record; and attraction of dust to the record.
- An effective dust and lint removal system.
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- Ultra-flat response—individually tested to within ± 1 dB.
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For more information on this remarkable new cartridge, write for the V15 Type IV Product Brochure (ask for AL569), and read for yourself how far Shure research and development has advanced the state of the art.

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HI FI NEWS — Continued

Photographic tricks department: view this picture the other way up and it looks what it is — a microphotograph of a groove. But, as presented it takes on the appearance of a ridge, now capable of being played and burnished to combat faults.

between signals derived from a stamper and those from the equivalent pressing.

Mechanically, the prospect of producing the bi-pointed stylus looked daunting indeed. The inside faces would have to be radiused so that they would relate appropriately to the sides of the ridge, while at all times clearing the top of the ridge. At the same time, the outer sides of the twin tips must not touch the walls of adjacent ridges.

With modulation, the ridge to be traced might diminish instantaneously to a height of 0.7 mil and be separated from the adjacent ridge by as little as 1.0 mil. With these dimensions, a conventional stylus with 0.7 mil radius can barely stay in the equivalent groove, but it usually gets fortuitous assistance from the slight "horns" which a typical cutter leaves above the surface on either side of the groove.

How might a "saddle" stylus fare?

After considerable deliberation, the Stanton bi-pointed stylus was designed with a radius for each tip of 0.5 mil and with a distance between tip centres of 1.4 mil. On this basis, it should contact the sides of the ridge in much the same area as touched by a conventional stylus riding in the equivalent groove. Engineers working on the project deduced that, with such dimensions, problems of pinch effect should be minimal, the more so because the stylus would be in contact with a surface much more rigid than that of a vinyl pressing.

Fortunately, for their peace of mind, a bi-pointed stylus was produced and it did work in promising fashion.

To put their theories to the practical test, however, it was also necessary to obtain access to the stampers from which normal test pressings had been made and to compare results between the two. In the ultimate a good degree of compatibility was evident, although the harder metal surface retained better control of the twin stylus, as evidenced by fewer minor resonances and more sustained response in the region 13 to 20kHz.

No less gratifying was the observation that, after 100 playings, there was no evident wear of the twin tips.

Availability of the bi-pointed stylus has has not only meant that faults in stampers could be identified readily but an important dimension has been added to the delicate technique of repairing or burnishing faults in matrixes, mothers and stampers.

Several years ago, Stanton developed a special stylus assembly for burnishing faults in mothers. When a ridge or other slight protrusion occurs in the groove of a mother, it can often be burnished smooth by playing across the area with a spherical tipped stylus weighted to something like 7 grams. By playing across the fault area for gradually increasing distances with gradually decreasing pressures, the fault can be merged smoothly with the rest of the groove.

If there are too many such faults, it becomes easier to repeat as much of the process as is necessary, even going back to the original tape master. With direct-to-disc recordings, this option is closed and there is a much stronger incentive to repair by any means possible.

One of the problems is that a scratch (ie, a depression) in the groove wall of a mother is not amenable to burnishing. However, as a corresponding protrusion on a ridge of a matrix or stamper, it can now be burnished with a bi-pointed stylus by the method described earlier.

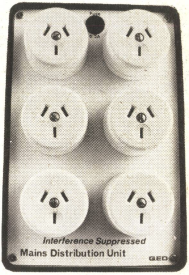
MAINS OUTLET WITH FILTERING

A new item, announced recently by M. R. Acoustics is intended to solve a dual problem which faces hifi enthusiasts: enough mains outlets to power their equipment, and a mains supply that is reasonably free from impulse noise transients.

Produced in conjunction with QED Audio Products Ltd, of the UK, the MIDU (Mains Interference Distribution Unit) provides six 3-pin outlets mounted on the panel of a moulded box measuring 65mm x 132mm x 200mm. The outlets, panel, mains lead and mains plug are in white, and the box is black, giving the appearance of a unit which is professionally designed and constructed.

As the distributors point out, it is a lot tidier and safer than the frequent cluster of 2-way adaptors.

Inside the box, both sides of the mains pass through an encapsulated filter assembly which is claimed by the manufacturers to discriminate against noise impulses over the freqency range 100kHz to 150MHz. It is a logical provision inside a distribution box of this nature, although its effectiveness will vary with individual installations. In general filtering is most effective when applied at the noise source, but one does always have that option, particularly as the current drawn by some such sources is quite high.



The Mains Interference/Distribution unit is not itself intended for heavy duty service, being rated by the manufacturers for a total maximum load of 1500 watts, appropriate for a group of hifi components. It is marked 6.3 amps and carries a miniature fuse in the front panel rated at that figure.

We gather from the distributors that the unit has been checked and okayed by the Queensland State Electricity Commission and it should therefore be appropriate for use anywhere in Australia.

Recommended retail price is $43.00, plus $3.00 to cover pack and postage and 50c for certified mail. Inquiries should be directed to M. R. Acoustics, PO Box 110, Albion, Qld 4010. Tel. (07) 48 7598 or 284 6764 or 265 1592.

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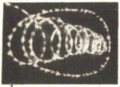

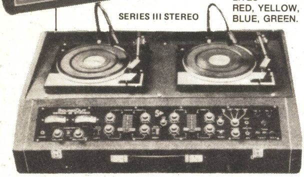

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HIFI NEWS — Continued

REALITY SEARCH specialises in audio equipment for the dedicated hifi enthusiast. One of the lines they are currently offering is a pre-preamplifier intended to connect between a low impedance moving coil cartridge and the phono input of a normal stereo amplifier. Gain is fixed at 32dB for a bandwidth of 15Hz to 1MHz. Unweighted noise referred to 1mV is —67dB, or —75dB after RIAA compensation. The unit is fitted with gold-planted RCA plugs and has a separate mains power supply. The price is $183.00.

Another item recently released is the TA-6 2-way speaker system. It uses a 200mm low frequency driver and a 38mm dome tweeter, with a 3rd order, 2000Hz crossover. The design, mechanically and electrically, is aimed at achieving linear phase. The claimed response is flat from 50Hz to 15kHz, being 12dB down at 28Hz, and the price is quoted $425. Other items of equipment are in the production "pipeline".

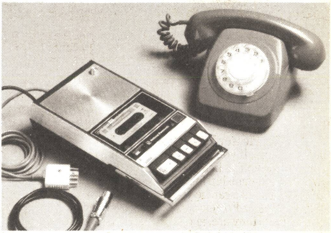
Reality Search is also the Sydney agent for Garrot Bros of Melbourne, and carries a stock of their parabolic styli, as well attending to customers who wish to change the stylus in existing cartridges.

The Reality Search showroom is Room 55, 5th Floor, 432-434 Kent St, Sydney. At present the showroom is attended only on Thursday evenings and Saturday mornings; at other times by appointment only. All correspondence to: Box 183, Strathfield, 2135. Phone (02) 29 1470.

HARMAN AUSTRALIA PTY LTD (P.O. Box 6, Brookvale, NSW 2100), represent White Instruments Inc, manufacturers of audio filters, equalisers and real time analysers.

White Instruments Inc. have just released details of their one-sixth octave band active equalisers, which cover the spectrum from 40Hz to 894Hz. The remainder of the range, 1000Hz to 15kHz, is covered by one-third octave equalisers. The adjustment range is plus and minus 10dB, using Mil-Spec rotary controls. Optional plug-in low-level crossover networks are available to facilitate use of the equalisers with two or three-channel power amplifiers.

White Instruments Inc also offer one-sixth octave real time analysers to go with the equalisers. They claim that tests in the Nashville area have shown a marked "smoothing" of the lower frequency response where the amplifier gain has been trimmed using the greater precision of the narrower equalisers.



Telecom Australia has sanctioned the use of a modified version of the National cassette recorder RQ-413-SP as an attachment to record telephone conversations. A signal box must be installed in the telephone circuit, into which the recorder plugs. Application for installation must be made on Telecom form TS72. Price of the recorder, ready for installation, is $170 and Telecom installation charge is around $25. When not in use for this purpose, the RQ-413-SP can be used as a normal, portable cassette recorder.

Sennheiser's MD416U dynamic cardioid mic has been developed to cope with the rigours of the pop scene, with a shock mounted element to absorb knocks and handling noise. Response is from 50Hz to 15kHz. (R. H. Cunningham Pty Ltd, PO Box 4533, Vic 3001.)

ELECTRO-VOICE AUSTRALIA PTY LTD announced recently that their range of available equipment extends to over 200 items, ranging from products intended primarily for the home hifi enthusiast to professional audio products for radio and TV studios.

They are established at 174 Taren Point Road, Taren Point, NSW 2229. Tel. (02) 525 8588.

New to the Electro-Voice range are two 100W speaker systems, which are compact and rugged, but ideal for touring bands, etc. Both include special protection circuitry for the wide-angle tweeter. The S12-2 is a 2-way system using a vented enclosure for the mid-range driver, making possible sound pressure levels up to 116dB. It is priced at $1100.

SANSUI ELECTRIC Co Ltd of Japan say that their Research & Development Division has devised a differential drive circuit for direct-coupled power amplifiers which greatly reduce possible transient intermodulation distortion and improve slew rate without involving penalties in other directions. Known as the "diamond differential drive", the new circuit is earmarked for inclusion in all future DC amplifiers.

AIWA (Aust) Pty Ltd announce that two new releases, while replacing existing lines, will offer advantages without any increase in price. The TPR-905 is a 3-band stereo radio cum cassette portable with in-built facilities to operate in conjunction with an external record player. It sells for $220. The new AD-6350 is a highly developed cassette deck, with all the usual facilities plus editing and an in-built timer. Recommended retail $375.

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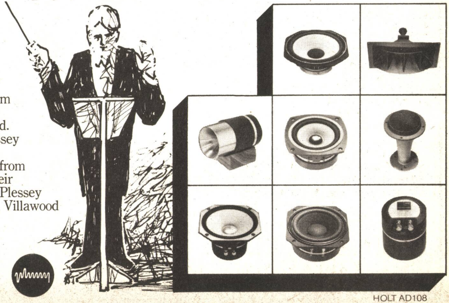

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The DM7 complements a remarkable range of monitor loudspeakers from B & W.

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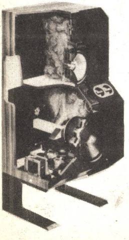
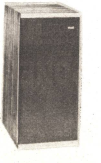
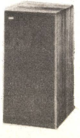


The DM4 is a 3-unit monitor loudspeaker system that produces high quality results from an incredibly small cabinet (20.8 litres) making it perfect for home or small studio use where space is at a minimum.



Only 28" x 9" x 9½". Despite its compact size, DM5 speakers can be rated as a system of very high quality. The design philosophy of John Bowers — "To design loudspeakers that reproduce in your home sound as you would hear in the concert hall".



NSW: CONVOY SOUND WOOLLOOMOOLOO SHOWROOM 357 2444; INSTROL HI-FI PTY.LTD. 29 7290; PARK ST. HI-FI STEREO CENTRE 26 2798; MILVERSON PTY.LTD. (CHATSWOOD) 412 2122 (PARRAMATTA) 635 3588; RIVERINA HI-FI 938 2663/4; UNITED RADIO DISTRIBUTORS PTY.LTD. 232 3718; ARROW ELECTRONICS 29 8580; RUSSIN HI-FI 799 2421; PITMAN'S RADIO & TV (WAGGA) 25 2155; ALBURY AUDIO CENTRE 25 1712; LEISURE SOUND (CHATSWOOD) 411 4944; WROTH CENTRE HI-FI (BATHURST) 31 2088; BYRON BAY TV & SOUND CENTRE 85 6762; SINGLETON HIGH FIDELITY CONSULTANTS 72 2270; HI-FI JUNCTION 389 4000; **ACT:** DURATONE 82 1388; **VIC:** SHEPPARTON HI-FI 21 9006; ENCEL ELECTRONICS PTY.LTD. 42 3761; SOUND SPECTRUM (GEELONG) 9 6616; SOUTHERN SOUND (CITY) 67 7869 (MOORABBIN) 97 7245; TIVOLI HI-FI 81 2872; THE SOUND CRAFTSMAN 509 2444; BUY RITE ELECTRIX 426200; NATSOUND 678158; INSTROL HI-FI 675831; INSTROL HI-FI (FRANKSTON) 783 7535; **QLD.** JOHN GIPPS SOUND 36 0080; PREMIER SOUND (NTH. ROCKHAMPTON) 27 4004; TARGA ELECTRONICS (CAIRNS) 53 2715; RUSS ADAM (TOWNSVILLE) 71 5618; **TAS.** BEL CANTO (HOBART) 34 2008; UNITED ELECTRONICS (LAUNCESTON) 318528; AUDIO SERVICES (BURNIE) 312390; **WEST. AUST.** TECHNICAL SERVICES PTY.LTD. 31 5455; THE GINZA 61 7444; **STH. AUST.** BLACKWOOD SOUND CENTRE 278 1281; INSTROL HI-FI 2237622; SOUND SPECTRUM 2232181.

Sole Australian agent:

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Teac A-107 stereo cassette deck

The Teac A-107 is top of a new line of stereo cassette decks recently released by Teac Australia Pty Ltd. It is a two-head machine with Dolby noise reduction, memory rewind and automatic cut-out for all functions. The machine impressed us with its high performance.

First impressions of the Teac A-107 are low key. Its styling is similar to many other decks on the market, which is probably inevitable with the constraints of front loading decks — mechanism on one side, and meters and controls on the other. However, when one becomes more familiar with the deck, the realisation dawns that it is very well thought out.

For example, to gain access to the heads, capstan and pinch roller it is a simple matter to remove the cassette compartment door — just grab hold of it and pull up, and off it comes. Replacement is equally easy. Other features of the cassette compartment are the backlighting and the gentle manner in which the door opens when the Eject lever is pressed. This is the result of a flywheel damping system which is quiet and simple.

Besides having an automatic cut-out for all tape functions (playback, record, fast forward and rewind), the mechanism has a "memory rewind" feature which allows cassettes to be rewound to a designated "000" setting of the tape counter.

Seven levers control the tape mechanism. They work well, with moderate pressure required. At times we found it difficult to initiate the recording function — the trick seems to be to fully depress the "Rec" lever first and then push the playback lever to start the mechanism.

On the other end of the control panel are two easily read level meters. They are labelled VU meters and their characteristics would appear to be a reasonable approximation to the ballistics of a VU meter. While that is well and good, it would have been advantageous if Teac had incorporated LED overload indicators. At least that is what we thought initially; it turns out that the deck has quite good signal "headroom" above the OVU level and this removes the need for overload indicators to a large extent. Much the same comment could be made about the need for a "limiter". There is none.

Below the two meters are four bar-shaped push-buttons. The first (from left) selects either the line or the mic/DIN inputs. There is no mixing provided here, which may be regarded as a drawback by some users. The second and third buttons select the bias and equalisation settings respectively for normal or chromium-dioxide tape, while the last button controls the Dolby noise reduction.

There is one drawback with these four buttons and indeed, with push-buttons in general. Their setting is not easily apparent at a glance.

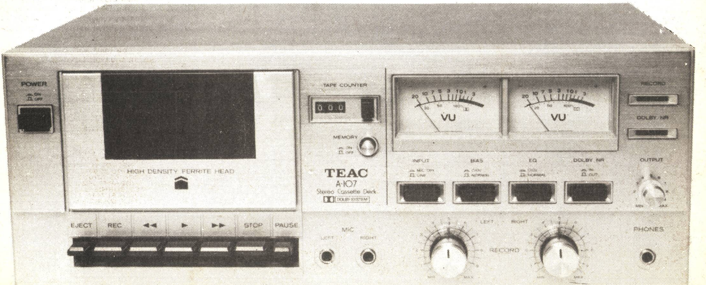
Individual recording level knobs are provided for both channels. Concentric with these knobs are what Teac calls "memory rings". These indicate the user's preferred settings for easy repeatability.

On the extreme righthand of the control panel is a diminutive knob for the output level control. This is the right size for a seldom-used control and seems to reflect the Teac approach of keeping things simple.

Sockets of 6.5mm are provided for stereo headphones and two low impedance (600 ohms or more) microphones. The output level at the headphone socket is not affected by the output level control setting. The same goes for the meter level indications during playback.

Two lamp indicators are provided, one for the recording function and the other to show that Dolby is in use.

The rear panel is bare except for the RCA inputs and outputs and the DIN



socket.

Removing the top cover of the A-107 reveals just how carefully this new machine has been designed. Whereas most stereo cassette decks are a veritable maze inside, the Teac is surprisingly empty and uncluttered.

All of the circuitry is accommodated on two printed circuit boards. There is one small PCB associated with the mechanism and one large PCB carries the remainder. There are relatively few interconnecting wires and even fewer shielded cables. All the switches and controls are mounted on the PCB. Plastic bars connect the push-buttons to the switches. It is all very neat. On the rear panel, the input sockets are soldered directly to a small PCB which connects via a ribbon cable to the main PCB. The same small PCB accommodates the output level potentiometer which connects to the front panel knob via a long shaft.

The main purpose of this careful design would appear to be reduction of labour costs. Most of the electronics of the machine would be assembled by machine. While this holds the production cost down, it also makes the machine more accessible for servicing, and the reduced hand assembly probably makes it more reliable.

While the design has all the appearances of being carefully thought out, the actual results are more important. Here it also showed up well.

Frequency response with BASF chromium dioxide at —20VU was within ±2dB from 40Hz to 15kHz, with a very sharp rolloff above 15kHz. This suggests the unit might have a built-in low-pass filter, to remove 19kHz pilot carrier from FM programs being taped. With TDK SA tape, the response was very similar, with the high frequency rolloff occurring at a slightly lower frequency.

Even more creditable, the frequency response at the minus 20VU level when Dolby was in use was very similar to that with Dolby out. This indicates a flat response in the first place and very careful matching of the Dolby recording and playback curves.

Harmonic distortion was low and typically below 1 per cent up to 0VU with a 1kHz signal. Unweighted signal to noise ratio was 50dB without Dolby. Switching in Dolby improves the unweighted reading by a few dB but would show a bigger improvement in a weighted noise measurement. Wow and flutter was 0.1 per cent DIN weighted.

Fast forward and rewind times for a C60 cassette averaged around 85 seconds. Auto stop at the end of any function takes three seconds.

Dolby recordings of music off-air or from high quality discs gave results which were virtually indistinguishable from the original sources.

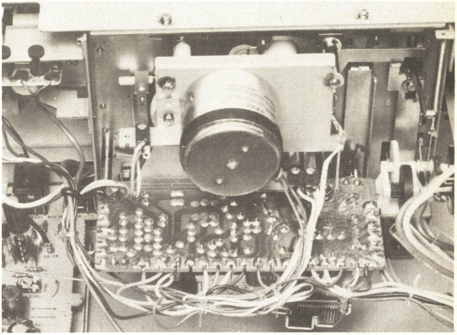
The owner's manual takes the form of a large sheet printed both sides and folded twice. It is brief and concise, and supplies most of the information needed. An additional brochure supplied with the unit gives more background information. A circuit is not supplied, which is a pity. We think that all equipment should be supplied with circuits so that there is a better chance of service being obtained far into the future.

One feature of the owners manual is a list of popular tape brands and appropriate bias and equalisation settings. While this is handy, it does not cover some of the more commonly available tape types available in Australia. Perhaps the local distributors could supply an addendum.

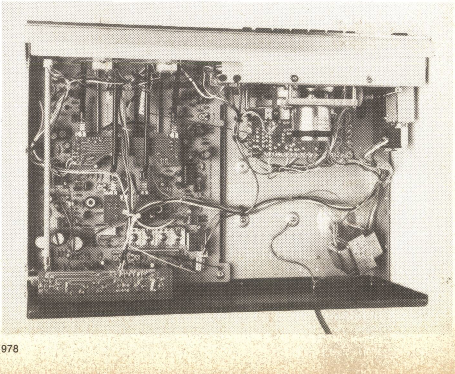
Our summary must be laudatory. It is particularly satisfying to review a machine of modest price (for these times) which gives such good performance. It gave results every bit as good as much more expensive machines we have heard.

About the only features we missed were mixing for the inputs and the provision for ferrichrome tape. Still, at the price most buyers will be able to live with this.

Dimensions of the Teac A-107 are 410 x 160 x 300mm (W x H X D) and mass is 7.5kg. Recommended retail price is $299.00. Further information on the Teac range of stereo cassette recorders can be obtained from high fidelity retailers or from the Australian distributors, Teac Australia Pty Ltd, 165 Gladstone Street, South Melbourne, Victoria. (L.D.S.)



These two photos show the uncluttered internal design of the Teac A-107.



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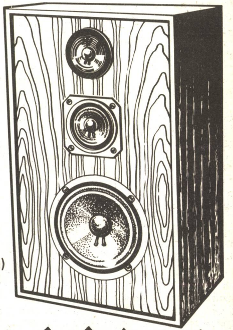

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Denmark declares war on so-called 'superamps'

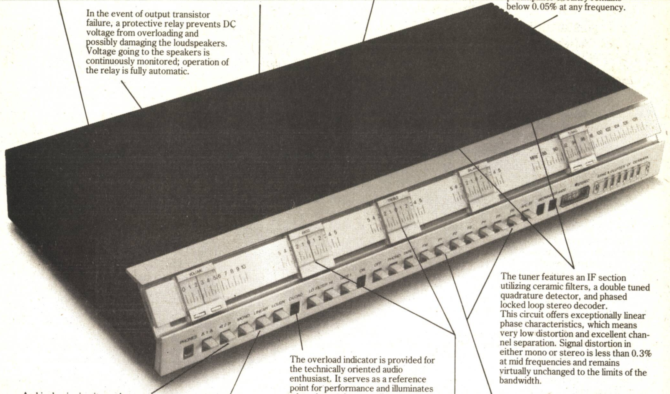
Our split power supply insures that each channel's signal remains completely independent. The power rating of the Beomaster 4400 is 2 X 75 watts RMS, with 0.05% total harmonic distortion, at full output with speakers of 4 ohm impedance.

A Bessel filter, incorporated with newly designed circuitry, eliminates Transient Intermodulation Distortion (TID) and its cause. Additionally, this new circuit gives the amplifier a virtually perfect square wave response, demonstrating that linear phase is maintained to the limits of the amplifier's bandwidth.

Eight, high power, cascade transistors eliminate crossover distortion in the output stage. They can handle the highest signal strength without performance deterioration.

Redesigned phono-preamplifier circuitry will handle any known input signal while limiting noise to more than 2 dB above the theoretical thermal noise limit of the cartridge itself. RIAA equalization is accurate to within 0.5 dB from 30-20,000 Hz. Total harmonic distortion within the preamplifier circuitry remains below 0.05% at any frequency.

In the event of output transistor failure, a protective relay prevents DC voltage from overloading and possibly damaging the loudspeakers. Voltage going to the speakers is continuously monitored; operation of the relay is fully automatic.



The tuner features an IF section utilizing ceramic filters, a double tuned quadrature detector, and phased locked loop stereo decoder. This circuit offers exceptionally linear phase characteristics, which means very low distortion and excellent channel separation. Signal distortion in either mono or stereo is less than 0.3% at mid frequencies and remains virtually unchanged to the limits of the bandwidth.

Varactor diode tuning permits up to six stations to be pre-set by the user for instant, electronically accurate recall at any time. Random FM tuning is accomplished with the smooth sliding tuning bar.

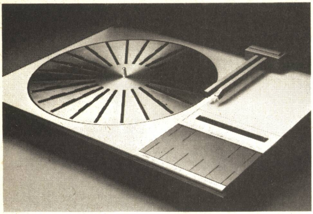
The overload indicator is provided for the technically oriented audio enthusiast. It serves as a reference point for performance and illuminates when the maximum undistorted output has been reached.

Ambiophonic circuitry, when completed with two additional side speakers, allows you to recreate much of the ambience and hidden sound information already present in stereo records, tapes, and FM transmissions. This circuitry will significantly increase your listening pleasure and the value of your present record collection.

The linear switch permits all tone control and volume compensation circuitry to be totally removed from the active circuit path. Depressing the lever eliminates all electronic noise generated by these circuits, and gives you a completely flat frequency response.

Tone controls are designed around active filter circuits. The cutoff curves were established by computer analysis and, most importantly, intensive listening tests. The controls introduce a minimum of distortion and a range surpassing the needs of any known music source.

Beomaster 4400 explodes the myth that 'power is the basis of clean sound'



It all started with "Superspinner"

Bang & Olufsen fired the first shot by introducing the "Superspinner" — Beogram 4002 — the first and still the world's only electronically controlled, automatic, straight-tracking turntable.

Beogram 4002 plays a record precisely as it was cut — from the edge to its centre in a straight line instead of tracing an arc. The result is sound quality audibly superior to all conventional turntables.

Inventiveness is one of Bang & Olufsen's best weapons.

Now the same creative engineering that produced the "Superspinner" has changed amplifier technology in such a way that power need no longer be considered a basis for producing clean, undistorted sound.

Beomaster 4400 - Here are the limits to how realistic a music system can sound

There will always be a difference between the original performance, and reproduced music.

A great many people overlook the fact that a music system can never produce better quality sound than the source material allows.

Records, tapes and radio transmissions all have inherent limitations — for example, there is rumble from the cutting machine in most record grooves.

However a great many people mistakenly believe that *all* distortion is created at the programme source. Whereas in most cases it is the components in a music system that are the weak links. Now Bang & Olufsen have produced Beomaster 4400, an amplifier/tuner with totally new circuitry that exceeds the most critical demands.

Beomaster 4400 challenges the chatter about distortion

Most makers of so-called "superamps" aggressively promote the fallacy that upwards of 2 x 150 watts RMS output, or a reversion to valve amplifiers is necessary to produce "undistorted" sound.

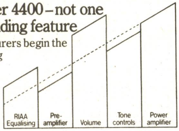
Many makers accept and ignore the presence of "transistor sound" — transient intermodulation distortion — so common in many of today's so-called superamps.

By analysing the problems mathematically instead of electronically, Bang & Olufsen have succeeded in *reducing all forms of distortion* –

total harmonic distortion,
intermodulation distortion,
transient intermodulation distortion.

This has been achieved by uniting a highly creative circuit design, numerous technical innovations and a specification that keeps touch with reality — the reality of the music you listen to.

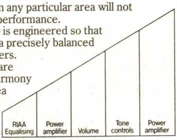
Beomaster 4400 - not one outstanding feature



Some manufacturers begin the beguile by attempting to establish "spectacular" data in one or two areas hoping to grasp technical pre-eminence.

The overall performance of such products almost always suffers.

Over emphasis in any particular area will not necessarily improve performance.



Beomaster 4400 is engineered so that every function bears a precisely balanced relationship to all others.

All components are matched in perfect harmony so that no specific area receives emphasis at the expense of another.

The result is a requirement for less power to create a crisper more real sound than many more expensive (more powerful) amplifiers have been able to produce.

Beomaster 4400 - not for the novice

It may seem provocative to enter the ranks of the superamp with a distortion specification of 0.05%.

But no less than this is necessary — the human ear has no hope of distinguishing distortion beyond this point.

It may appear cheeky to stand among the "superamps" with a power rating of 2 x 75 watts RMS — yet Beomaster 4400 is (as Rolls Royce have said on the question of power) "adequate" for any domestic music system.

With its Bessel filter and reformulated circuitry eliminating Transient Intermodulation Distortion and its cause . . .

With its eight high power cascade transistors capable of handling the highest signal levels, eliminating cross-over distortion in the output stage . . .

With its newly designed phono-preamplifier capable of handling any known signal strength — while insuring a noise level of no more than 2 dB over the theoretical limit of any high quality cartridge . . .

With its split-power-supply insuring each channel's signal remains completely independent . . .

. . . Beomaster 4400 is certainly worthy of closer inspection by the serious enthusiast including those who still refuse to believe that a transistorised amplifier can compete with a valve model for sheer musical purity.

Bang & Olufsen suggest that a demonstration at any of the stockists listed below will convince even the most unbending sceptic that Beomaster 4400 exceeds the demands of the most highly trained sensitive ear, and the requirements of the most advanced audio system — without the need for bulk power or a "paper" specification.

Bang & Olufsen

Simply the best.

Victoria: Danish Hi-Fi, Shop 9, Southern Cross Hotel, Melbourne. Tel. 63 8930. Danish Hi-Fi, 698 Burke Road, Camberwell. Tel. 82 4839. Danish Hi-Fi, Cnr. Beach & Olsen Streets, Frankston. Tel. 783 1695. **New South Wales:** Deeva Hi-Fi, 326 Pacific Highway, Crows Nest. Tel. 439 3999. **Queensland:** Brisbane Agencies Audio Centre, 72 Wickham Street, Fortitude Valley. Tel. 221 9944. **Western Australia:** Danish Hi-Fi, 256 Stirling Highway (in the Rolly Tasker Building), Claremont. Tel. 384 2852. **South Australia:** Ernsmiths, 50 King William Street, Adelaide. Tel. 51 6351. **Tasmania:** Bel Canto, 138 Liverpool Street, Hobart. Tel. 34 2008. BO936/1

Upgraded 200MHz digital frequency meter

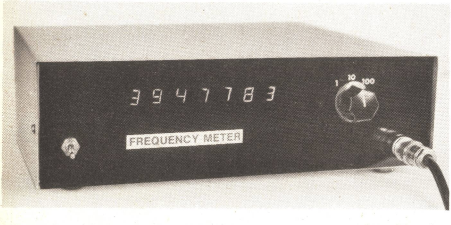
... new counter runs to 40MHz without prescaler

Our popular 200MHz seven-digit frequency meter has now been upgraded for greatly improved performance. It can now measure up to 40MHz without the need for the prescaler. There is less wiring and easier adjustments.

by LEO SIMPSON

Since publication of the low cost 200MHz digital frequency meter in March 1977, over 1000 have been built. However, in the months following publication of the design, a number of minor problems came to light, notably in the front end. Now, with a change in the supply situation for the LED displays, it has become both necessary and opportune to revamp the design.

The new front end is entirely different from that of the March 1977 circuit and minor changes have also been made to the prescaler and timebase sections. Both PC boards are changed, although the same metalwork is retained. The new PC boards will directly mate with the old metalwork.



Apart from the circuitry changes, most of the features of the 1977 design remain unchanged, although some performance parameters are upgraded. For the benefit of readers not familiar with the design, we shall again describe it in detail.

The new frequency meter is housed in the original low-profile case, measuring approximately 230 x 68 x 210mm (W x H x D). The front panel is made of screen printed red polaroid film (or thick red perspex). When the power is off, the front panel is dark, with no digits showing. When power is applied, all seven digits are alight.

The range switch has three positions: x1, x10 and x100. On the first range measurements can be made to above 3MHz, while the second range multiplies the limit of the first range by 10. On the third of x100 range measurements can be made to above 200MHz, depending on the signal amplitude.

Input impedance of the meter on the "x1" and "x10" ranges is approximately 1 megohm shunted by about 50pF. Sensitivity on these two ranges is 30mV RMS or better from 20Hz to 20MHz, reducing to 100mV RMS at 30MHz. On the "x100" range, the input impedance is 50 ohms and input sensitivity is about 200mV RMS up to about 180MHz. Maximum operating frequency is typically 200MHz while the minimum input frequency on this range is 1MHz.

Accuracy of the frequency meter will depend on the accuracy and stability of the crystal timebase. This can be expected to be eithin a few parts in 100,000. Resolution is 1Hz on the "x1" range, 10Hz on the "x10" range and 100Hz on the "x100" range.

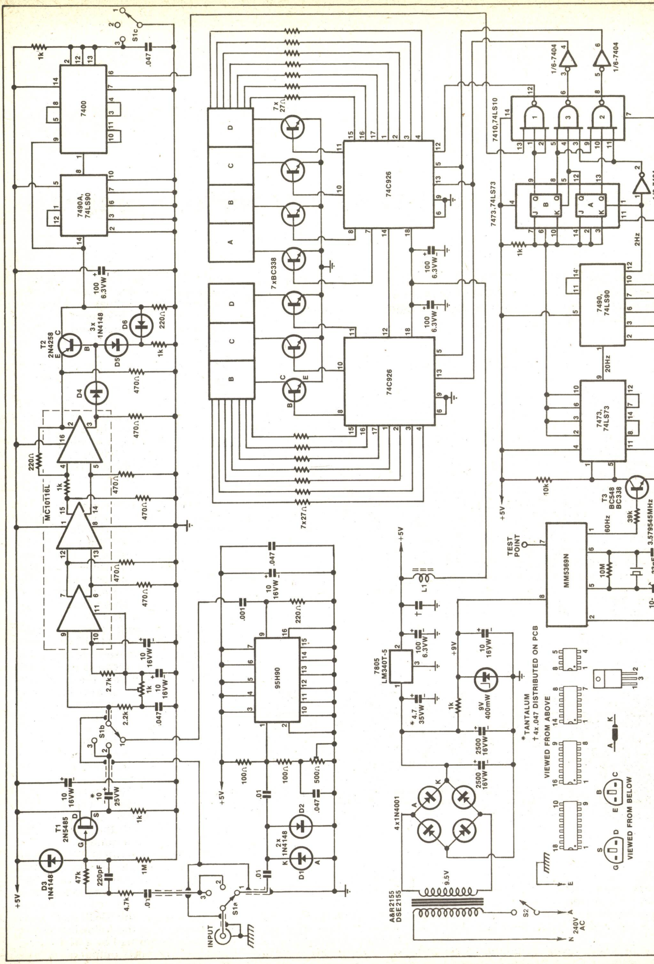
Power consumption is fairly modest. Current drain is between about 500 and 600 milliamps from the 5V regulated supply, depending on whether the prescaler (used on x100 range) is in use. The unit is normally powered from the 240VAC mains, but could be run from a 12V battery in a car.

Heart of the design is a pair of 74C926 CMOS 4-decade counters, made by National Semiconductor Corporation. Contained in the 74C926 package are four decade counters, four 4-bit latches, BCD to seven-segment decoder-drivers, plus an oscillator and multiplexing circuitry for the four digit driver transistors. Thus, depending on how the comparison is made, the 74C926 is equivalent to between eight and 12 conventional TTL IC's.

Another specialised device from National Semiconductor is used in the timebase circuitry. It is the MM5369N CMOS programmable oscillator/divider, which can be programmed during manufacture to divide by any selected number between 10,000 and 98,000.

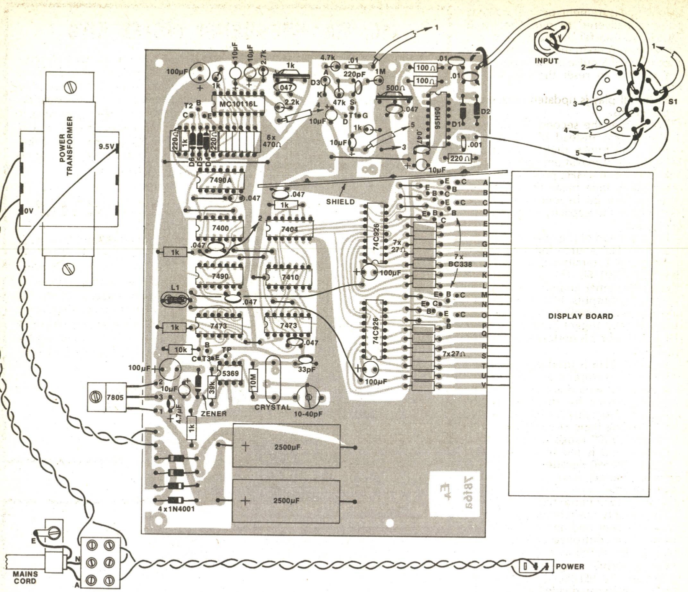
The particular device used by us is programmed to work with an American standard colour TV subcarrier crystal operating at 3.579545MHz. Output from the 5369 is 60Hz. This is a very economical method of obtaining a timebase since both the 5369 and the 3.58MHz crystal are quite cheap.

The MM5369N is run at 9V to ensure that it does operate at 3.58MHz (this was not a problem with our 1977 design, although we have modified it in this respect to conform to specifications for the 5369). Interfacing from the 5369 to the following 5V TTL circuitry is performed by a BC548 NPN transistor. The 60Hz output is fed to a



200MHz 7-DIGIT FREQUENCY METER Mk. II

7/F/

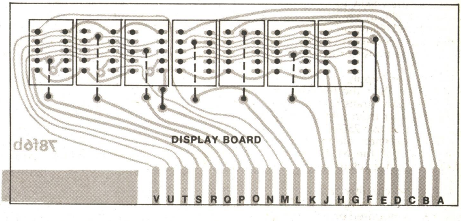


These two diagrams give all the wiring details for the new frequency meter.

7473 dual JK flip-flop interconnected to divide by three, to give 20Hz. This signal is further divided by a 7490 decade counter to give 2Hz.

The 2Hz square wave output from the timebase circuitry is interfaced with the 74C926 counter ICs in what is termed a "housekeeping" circuit. This consists of a 7473 dual JK flip-flop, a 7410 triple 3-input NAND gate and a 7404 hex inverter.

Three different pulse trains are derived from the 2Hz timebase by the housekeeping circuitry, to control the 74C926s: One second pulses for gating, and 250mS pulses for "reset" and "latch enable". Let us explain the term "latch enable".



As noted above, each 74C926 has four 4-bit latches. These are equivalent to a chain of flip-flops which are used to store the BCD count of the four decade counters. The latch information is used to drive the LED displays. Early frequency counters did not have latches and so the display was rapidly cycled during each count period. With latch circuitry the readout is constant if the input frequency is constant — there is no blinking or flickering.

So the "latch enable" pulse is the command to the 74C926 to transfer the BCD count from the decade counters to the 4-bit latches.

The basic measurement cycle takes two seconds. In the first second, gate 1 of the 7410 is turned on by the second flip-flop in the 7473 to allow a one second burst of input signal to be fed to the clock input (pin 12) of the first 74C926. The first 74C926 counts the first four decades (to 9999) and generates "carry out" pulses to allow the second 74C926 to count the following decades.

During the third half-second of the 2-

second measurement period a 250mS pulse is delivered to pins 5 of both 74C926s to transfer the BCD count into the latches. Then in the last half-second another 250mS pulse is fed to pins 13 of the 74C926s to reset the counters to zero.

So the display is updated once every two seconds.

Notice that the second 74C926 only drives 3 digits instead of 4. We have omitted the fourth digit, because the 74C926 typical maximum count rate of between 3 and 4MHz plus the one second gating time mean the maximum count cannot go beyond 4,000,000 — well within the capacity of seven display digits.

The front end of the new design consists of a FET source-follower and a Motorola ECL (emitter-coupled logic) device, MC10116L. The MC10116L is a triple differential amplifier with complementary outputs. It is connected to perform as an amplifier and very high speed Schmitt trigger. Interfacing from ECL to TTL levels is performed by a PNP transistor.

The MC10116 is used in quite a few current commercial frequency counters and would appear to be best available device for this function. Its frequency capability is well in excess of the following logic circuitry.

On the "x10" range the signal from the front end is fed to a high speed 7490A or 74LS90 decade divider. These decade dividers have a typical maximum toggle rate of 40MHz and a guaranteed minimum figure of 32MHz.

To simplify switching, the signals from the front-end and 7490A decade dividers are controlled by a 7400 quad 2-input gate wired as a SPDT switch.

On the "x100" range the input signal is fed to the 95H90, a Fairchild ECL device, which can divide by 10 or 11 (10, in this case). The output from the 95H90 is coupled to the MC10116L, and thence to the 7490A to obtain a signal division of 100. By coupling the 95H90 to the MC10116 instead of direct to the 7490A, the need for a separate ECL to TTL interface transistor from the 95H90 is eliminated.

The power supply is a little more complicated than the 1977 design. A 15V secondary transformer drives a bridge rectifier from a 9.5 tap. Filtering is provided by two 2500uF capacitors in parallel. A zener diode is used to provide 9V for the MM5369, while a three-terminal regulator derives the 5V rail.

All of the circuitry, apart from the transformer, range switch and readouts, is mounted on a PCB measuring 178 x 127mm and coded 78f6a. The seven LED displays are accommodated on a separate PCB, measuring 118 x 53mm and coded 78f6b. This board is mounted and secured at right angles to the main PCB, at the front.

Before assembly, both boards should be carefully examined for faults in the copper pattern. These may take the

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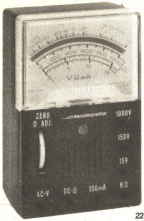
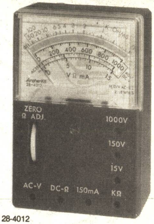

22-027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1000 Ohms/V Pocket Tester— 8 Ranges

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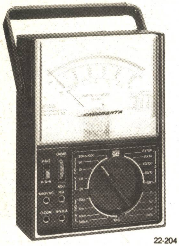
22-204

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•Single-knob function switch •Overload protected

DC Volts: 0-250mV, 2.5-10-50-250-1000 at 50 kΩ/V;0-125mV, 1.25-5-25-125-500 at 25kΩ/V; AC Volts; 0-10-50-250-1000 at 10kΩ/V; 0-5-25-125-500 at 5kΩ/V. DC Current: 0-50 *u*A, 5-50-500 mA, 10A at 50 kΩ/V; 0-25 *u*A, 2.5-25-250mA, 5A at 25 kΩ/V. Resistance: Rx1, Rx10, Rx100, Rx1000, Rx10,000 (10 ohms centre scale). Decibels: -20 to +62,8 ranges. Accuracy ±3% DC. ±4% AC. 16.9x12.3x5.0cm. Comes with leads, batteries, instructions.**22-204**........... **37.95**

43-Range Multitester Kit

•50,000 Ohms Per Volt
•Range Doubler Aids Low-Voltage Accuracy

11.4cm mirrored scale, overload protection, more. DCV: 0-500 at 50k/V, 0-1000 at 25k/V. ACV:0-500 at 10K/V, 0-1000 at 5k/V. DC Current: 0-10A. Resistance: Rx10k dB: -20 to +62. Accuracy: ±3% DC, ±4% AC. Req. "AA" & 9V batteries. 17.1x12.3x5.3cm. With leads. **28-4014**.. **34.95**

22-208

28-4013

28 Ranges — 10 Megohms/Volt

•Dual FETs •Mirrored 12.7cm Scale
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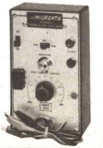
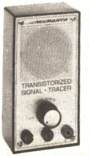
25-Range Multitester Kit

•20,000 Ohms Per Volt
•Colour-Coded Scale

10.1cm mirrored scale. DC Volts: 0-1200 at 20k ohms/ volt. AC Volts: 0-1200 at 10k ohms/volt. DC Current: 0-60 *u*A-300 mA. Resistance: Rx1-Rx1000 (24 centre scale). dB: -20 to +63, 5 ranges. Accuracy: ±3% DC, ±4% AC. 14.2x8.8x3.8cm. With leads, instructions. Requires "AA" battery. **28-4013**......................... **21.95**


22-024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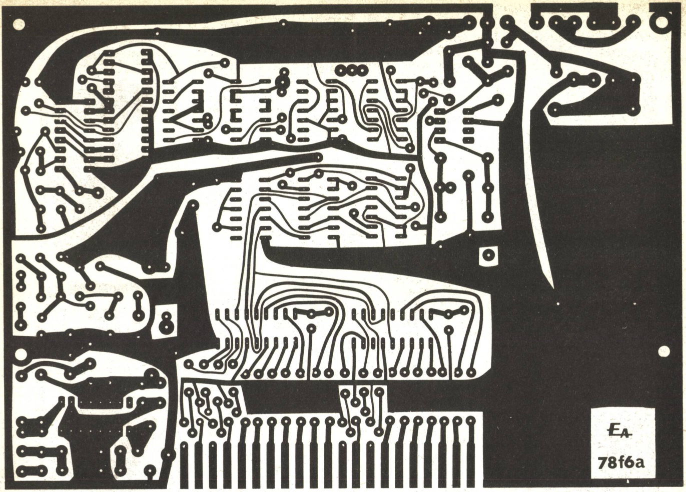


PARTS LIST FOR THE 200MHz FREQUENCY METER

MAIN PCB ASSEMBLY

1 PCB, 78f6a, 178 x 127mm
1 3.579545MHz crystal
19 PC pins
1 inductor: 13mm balun former with 10 turns 26 B&S enamelled copper wire.

SEMICONDUCTORS

2 74C926 4-digit counters
1 MC10116L ECL triple differential amplifier
1 95H90 ECL prescaler
1 MM5369N oscillator/divider
1 74LS90 or 7490A high speed decade counter
1 7490 decade counter
2 7473 dual JK flip-flops
1 7410 3-input NAND gate
1 7404 hex inverter
1 7400 quad 2-input NAND gate
1 7805 or LM340T/5 5V regulator
7 BC338 switching transistors
1 BC548 NPN transistor
1 PN4258, 2N4258, 2N6001 PNP high speed switching transistor
1 2n5485 or similar VHF FET
6 1N914, 1N4148 silicon signal diodes
4 1N4001 silicon rectifier diodes
1 9V 400mW zener diode

CAPACITORS

2 2500uF/16VW electrolytic
4 100uF/6.3VW PC electrolytic
3 10uF/16VW PC electrolytic
2 10uF/25VW tantalum electrolytic
1 4.7uF tantalum electrolytic
9 0.047uF ceramic or metallised polyester
3 0.01uF ceramic
1 220pF ceramic or polystyrene
1 33pF NPO ceramic
1 10-40pF ceramic trimmer (Stettner)

RESISTORS

(¼ or ½W, 10% tolerance)
1 x 10M, 1 x 1M, 1 x 47k, 1 x 39k, 1 x 10k, 1 x 4.7k, 1 x 2.7k, 1 x 2.2k, 7 x 1k, 6 x 470 ohms, 3 x 220 ohms, 2 x 100 ohms, 1 x 47 ohms, 14 x 27 ohms,
1 x 1k trimpot, 1 x 500 ohms trimpot.

READOUT PCB ASSEMBLY

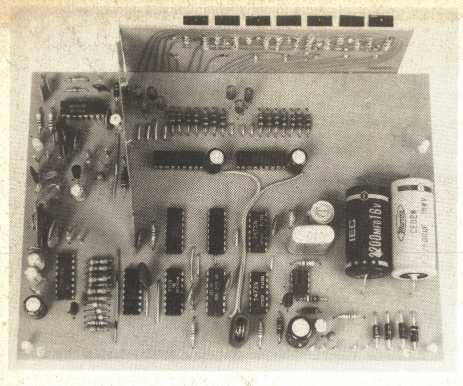
1 PCB, 78f6b, 119 x 53mm
7 seven-segment common cathode LED displays, Liton LT-303 or equivalent

CHASSIS & HARDWARE

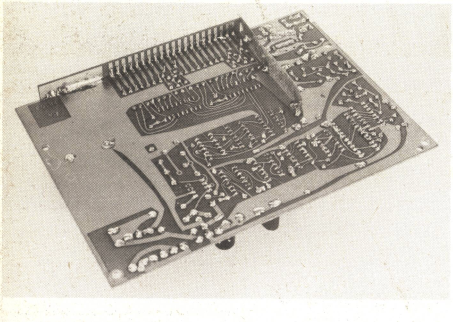
1 chassis and cover
1 front panel (screen-printed red polaroid film).
1 BNC socket, single-hole mounting
1 knob
1 SPST miniature toggle switch
1 4 pole three-position switch
1 power transformer, 15V centre-tapped at 1 amp DC; A&R 2155, DSE 2155
4 rubber feet
4 Richco 10mm high PCB supports
1 solder lug
1 three-pin mains plug and three-core flex
1 mains cord clamp and grommet
1 three-way insulated terminal block

Miscellaneous: screws, nuts, lock-washers, hook-up wire, tinned copper wire, insulation tape, solder, etc.

Note: Capacitors and resistors with high ratings may be used if physically compatible. Other substitutions, unless mentioned in the text, are not recommended.



These two photos show the PCB assembly. Note the shields top and below.



form of breaks in the fine copper tracks, or shorts between adjacent tracks. If any faults are found, they should be repaired at this stage.

Take care, when making solder joints, to avoid damage to the PCB pattern. Be wary of making solder "bridges" or overheating pads until they lift. Use a low wattage soldering iron with a small chisel-shaped bit.

Fit all the wire links first, then mount the components and PC pins. Leave the 5369 and 74C926 IC's until last. Note that all of the IC's with the exception of the 74C926's and 95H90 are oriented in one direction — with notched ends toward the rear of the PCB.

We have not found it necessary to take any special precautions when soldering the CMOS ICs except to use a small low voltage iron. If you are worried, connect the soldering iron to the PCB earth pattern with a jumper lead and then solder the supply and earth pins of the CMOS ICs first.

We have specified BC338 (or BC337) transistors for the digit drivers because of their low collector saturation voltage. It is possible to substitute BC548, but the readouts will not be as bright and there is also the likelihood that they will not all have the same brightness.

Pin 7 of the MM5369N is a buffered output for the 3.5MHz oscillator. However it is of no real use in calibration. It could be handy for troubleshooting to check that the oscillator is actually running.

Low power Schottky IC's may be substituted for all TTL devices in the circuit. This has the advantage of lowering the power consumption.

The 2N4258 transistor following the MC10116L is a very high speed switching type. Do not substitute types other than those listed unless they are known to be suitable for high speed switching applications.

The readout PCB is easy to assemble. It uses seven LT303 common-cathode displays made by Taiwan Liton Electronic Company Ltd. These displays are available from Dick Smith Eectronics Pty Ltd. Parts retailers may obtain supplies from D. S. Distributors, 24 Carlotta Street, Artarmon, NSW 2064.

Solder in the wire links to the readout PCB before installing the LED displays. Note that MAN-7 or DL-704 LED displays are not compatible with this board.

The readout PCB is attached to the main PCB by soldering the line of pads together on both. Alignment marks are provided near the lower edge of the display PCB. These should be lined up with the edge of the main PCB. Use a couple of stout tinned copper wires soldered to the copper pattern of both PCBs, to hold them in alignment (and perpendicular to each other) while soldering each of the pads takes place. This takes care of all connections between the PCBs.

Now assemble the chassis hardware. Solder the mains leads to the power transformer, tape them and bolt the transformer to the chassis.

The screen printed Polaroid panel should be attached to the chassis with a suitable adhesive or double-sided adhesive tape, along with the two switches and input socket.

If you are unable to obtain a screen printed Polaroid front panel from kitset suppliers, red Polaroid film can be purchased from the Customer Service Division of Polaroid Australia Pty Ltd, Waterloo Road, North Ryde, NSW 2113. Labelling may be added with white Letraset.

The input socket may be a single hole mounting BNC type or a single hole mounting UHF type to take a PL259 connector. The mounting hole needs to be larger for the latter type.

The three-core mains cord should be passed through a grommetted hole in the rear of the chassis and anchored with a cord clamp. Terminate the earth wire to a solder lug on the chassis. Terminate the active and neutral conductors plus the wires to the transformer primary and the mains switch to a three-way insulated terminal block.

Next month we shall complete the description of construction, give details of adjustment and calibration. Also featured will be a usrful troubleshooting procedure and a list of hints in using the new frequency meter.

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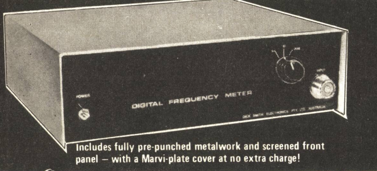

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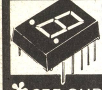

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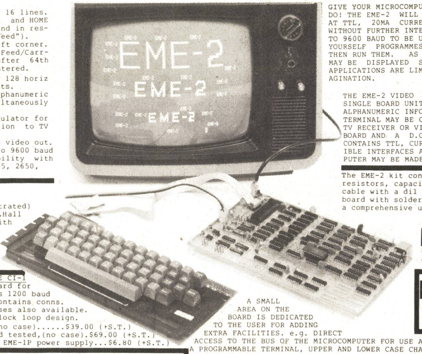

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Build this simple utility timer

There are many situations where a timer-cum-alarm unit can prove a very handy gadget indeed. Our new Utility Timer can accurately time intervals of up to four hours or more, and features 11 useful time intervals ranging down to 15 seconds. The unit is battery powered but can also be run from a mains plug-pack power supply.

by GREG SWAIN & DAVID EDWARDS

Many readers have probably already thought of a use for this low-cost timer unit by now. Applications which spring immediately to mind include a parking meter reminder, an egg timer and a "phone back" reminder. Or perhaps you could use it to remind you to move the garden hose, or that your TV movie is about to start.

Whatever your application, you will find our Utility Timer easy to build and easy to use. To operate the unit all you have to do is select the desired time interval and move the toggle switch to the start position. The unit will then start counting and, at the end of the preset time interval, it sounds a small buzzer.

Let's take a look at the circuit. As you can see, it's really very simple.

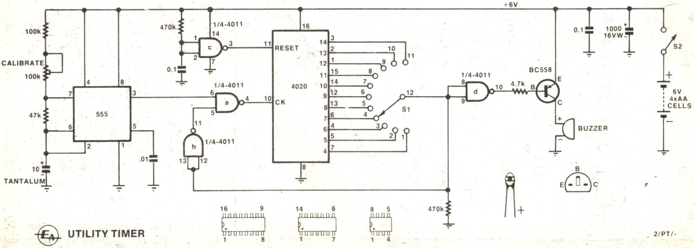
Basically, it consists of a "clock" oscillator driving a 14-stage ripple carry binary counter, together with a quad 2-input NAND gate. The clock is implemented using a 555 timer IC, and has a nominal period of 1.758s. This nominal period can be adjusted plus or minus 20% by the 100k calibrate trimpot, partly to take care of component variations and also to allow the unit to be accurately calibrated to the desired time ranges.

The clock output is fed from pin 3 of the 555 via NAND gate "a" to the ripple counter, a 4020 CMOS device. The counter is advanced one count on the negative transition of each clock pulse, and can be reset to the zero state by a logical "1" at the reset pin (pin 11).

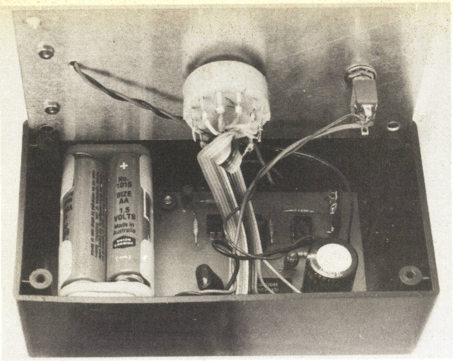
In our circuit, the reset function is automatic with switch-on. Initially, the 0.1uF capacitor at the input to gate "c" is discharged, forcing the output of the gate high to reset the counter. The capacitor then charges via the 470k resistor to remove the reset pulse from the counter after a short delay.

The number of clock pulses counted by the ripple counter (and hence the time interval) is determined by the setting of the 11-position switch. When the counter output selected by the switch goes high, the output of gate "b" is forced low. This in turn forces the output of gate "a" high, stopping the clock pulses to the counter.

A plastic "zippy" box was used to house the prototype Utility Timer.



A 555 clock driving a 4020 14-stage ripple counter forms the heart of the circuit.



View inside the completed Utility Timer. Take care when mounting the PC board to ensure that the large electro does not foul the off/start switch.

PARTS LIST

1 case, 130 x 68 x 41mm
1 front panel (see text)
1 1-pole, 12-position rotary switch
1 SPDT miniature toggle switch
1 printed circuit board, coded 78tm8, 59 x 71mm
4 1.5V penlight cells
1 4-way battery holder to suit
1 miniature buzzer, 6 VDC operating voltage
2 2.1mm DC input jack (optional, see text)
Hookup wire, PCB pins, battery clip, machine screws & nuts, solder

SEMICONDUCTORS
1 555 timer IC
1 4011 quad 2-input NAND gate
1 4020 14-stage binary counter
1 BC558 PNP transistor

RESISTORS (all ¼W)
1 4.7k, 1 47k, 1 100k, 2 470k, 1 100k trimpot

CAPACITORS
1 1000uF 16VW PCB mounting electrolytic
1 10uF tantalum electrolytic
2 0.1uF polyester
1 0.01uF polyester

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible.

At the same time, a small buzzer unit is driven by gate "d" and a BC558 transistor, to sound the alarm.

Four 1.5V penlight cells are used to power the unit or, alternatively, it may be powered from the mains via a 9V plug pack. Filtering of the supply line is provided by a 1000uF electrolytic capacitor and a 0.1uF polyester capacitor.

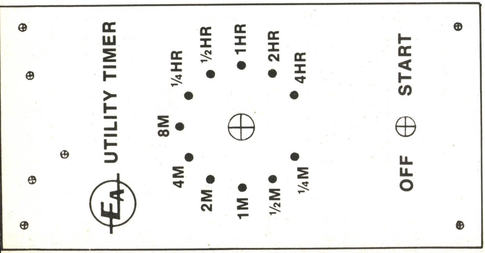
We should now explain that the interval calibrations marked on the front panel will not be accurate over the entire range for any one setting of the calibrate trimpot. This is because the range switch actually selects binary intervals, ie. in a 1, 2, 4, 8, 16 etc relationship. For example, if we calibrate the unit so that the shortest time interval is ¼ minute exactly, then the longer intervals will be: ½ minute, 1 minute, 2 minutes, 4 minutes, 8 minutes, 16 minutes, 32 minutes, 64 minutes, 128 minutes and 256 minutes.

As you can see, the front panel calibrations will only be accurate up to 8 minutes in this case. For longer intervals, those marked in hours, there are discrepancies. For the most part, these discrepancies are fairly small, at least up to the 2 hour calibration setting which is still only 8 minutes out. This error has grown to 16 minutes for the 4 hour calibration setting, though.

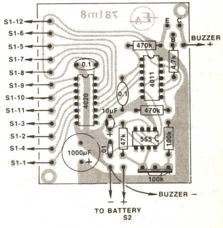
The alternative is to set the calibrate trimpot so that the longest time interval will be 4 hours exactly. Our time intervals will now be: 0.23 minutes, 0.47 minutes, 0.94 minutes, 1.88 minutes, 3.75 minutes, 7.5 minutes, 15 minutes, 30 minutes, 60 minutes, 120 minutes and 240 minutes. The calibrations marked in hours will now be accurate, but there will be discrepancies for the minutes calibrations.

Again, these discrepancies can be considered quite small, the largest error being 30 seconds at the 8 minute setting.

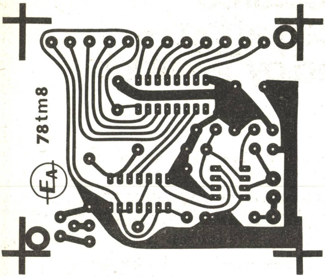
What it all means is that you have a choice when calibrating your Utility Timer. You can tweak the calibrate trimpot for accurate readings either on the minutes ranges, or on the hours ranges.

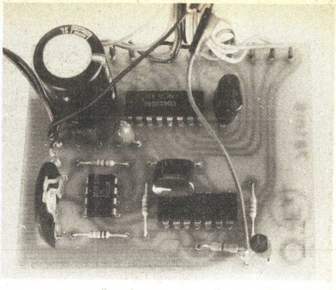


Actual size reproduction of the front panel artwork.



The overlay pattern shows the PC board from the component side. Pay attention to component orientation.





At top is a close-up view of the assembled PC board. Observe the usual precautions when soldering the CMOS devices. At left is an actual size reproduction of the PC artwork.

Construction of the unit is quite straightforward. As can be seen from the photographs, the unit is built up on a small PC board coded 78tm8 and measuring 59 x 71mm. This board accommodates all of the circuitry excepting the switches, batteries and buzzer unit.

An economical plastic "zippy" box measuring 130 x 68 x 41mm and available from most parts suppliers was used to house the timer. The front panel was made from photosensitive aluminium, but we assume that commercial panels will be available shortly after this article appears.

Commence construction by wiring up the PC board according to the circuit and component overlay diagrams. Fit all discrete devices and the 555 chip to the board first, taking care to orient polarised components correctly. Use PC stakes and rainbow cable for external connections from the board to the front panel switches.

The 4011 and 4020 ICs are CMOS devices and should be left till last. When soldering them into circuit, the following precautions should be observed to avoid damage from static charges: (1) earth the barrel of your soldering iron to the earth track on the PC pattern; (2) solder the power supply pins first. The power supply pins for the 4011 device are pins 7 (earth) and 14 (+V), while those for the 4020 device are pins 8 (earth) and 16 (+V).

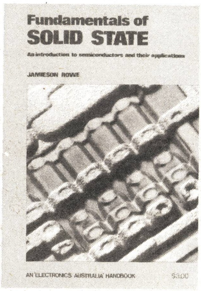
The four penlight cells are accommodated in a 4-way battery holder which sits at the top of the case. A piece of foam can be used to ensure that the holder stays in position when the lid is screwed down, and to prevent shorts.

Use of the unit with an external plugpack power supply is optional. If you wish to incorporate this feature, then a 2.1mm DC input jack can be mounted at the end of the case nearest the start switch. We chose not to wire the jack into the prototype.

The alarm unit used in the prototype is a miniature solid state buzzer of the type sold by Dick Smith Electronics Pty Ltd. This is mounted at the top of the front panel, as shown in the photograph.

Once construction is complete, the unit can be switched on and tested for correct operation. Do not forget to check for correct operating using both the internal battery and the external plug-pack. If the unit fails to operate correctly, check carefully for missed solder joints, incorrect wiring, or components inserted the wrong way around.

Assuming correct operation, the unit can now be calibrated for accurate readings on either the hours or the minutes ranges, as described previously. Calibration is best affected with the interval switch set to the 1 minute range. Adjust the calibrate pot to give 1 minute exactly for accurate minute readings, or 56 seconds (56.25 to be precise) for accurate hour readings.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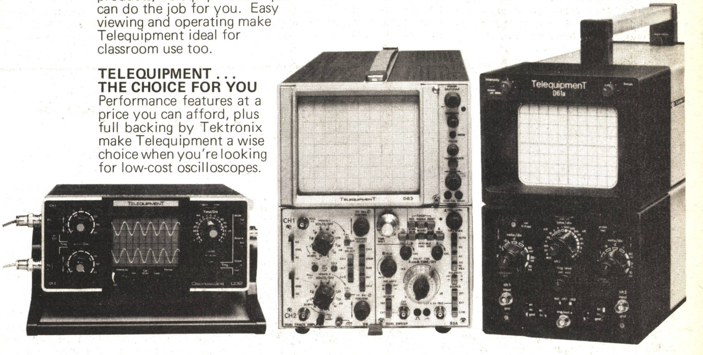

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S5 – ETI 485. Graphic Equalizer
S6 – ETI 480. 50 watt Amplifier
S7 – ETI 480. 100 watt Amplifier
S8 – ETI 480 Ps. Power Supply for Above
S9 – ETI 443. Expander Compressor
S10 – ETI 444. Five Watt Stereo
S11 – ETI 422B. Booster Amplifier
S12 – ETI 438. Audio Level Meter
S13 – ETI 440. 25 watt Stereo Amplifier
S14 – ETI 420. Four channel Amplifier
S15 – ETI 420E. SQ Decoder
S16 – ETI 423. Add-on Decoder Amplifier
S17 – ETI 422. 50 Watt per channel Amplifier
S18 – ETI 426. Rumble Filter
S19 – ETI 429. Simple Stereo Amplifier
S20 – ETI 416. 25 Watt Stereo Amplifier
S2 – ETI 417. Over Led Distortion Monitor
S22 – ETI 410. Super Stereo Sound Source Width Control
S23 – ETI 425. Integrated Stereo System
S24 – ETI 427. Graphic Equalizer
S25 – E.A. Playmaster 10 + 10
S26 – E.A. Playmaster 128 40 watt
S27 – E.A. Playmaster 132 40 watt
S28 – E.A. Playmaster 136 13 watt
S29 – E.A. Playmaster 137 3 watt
S30 – E.A. Playmaster 143 12.5 watt
S31 – E.A. Playmaster Twin 25 watt
S32 – E.A. Musicolour II 1000 w ch
S33 – E.A. Musicolour III 1000 w ch
S34 – E.A. Stereo Dynamic Noise Filter

AUDIO TEST UNITS

AT1 – ETI 441. Audio Noise Generator
AT2 – ETI 128. Audio Millivolt Meter
AT3 – ETI 112. Audio Attenuator
AT4 – ETI 102. Audio Signal Generator
AT5 – E.A. A.F. Tone Burst Generator
AT6 – E.A. Laboratory Solid State A.F. Generator
AT7 – ETI 137 Audio Oscillator

TEST EQUIPMENT

TE1 – ETI 134 True RMS Voltmeter
TE2 – ETI 133. Phase Meter
TE3 – ETI 533c. Digital Display 1976 Display
TE4 – ETI 129. R.F. Signal Generator
TE5 – ETI 130. Temperature Meter
TE6 – ETI 706. Marker Generator
TE7 – ETI 709. R.F. Attenuator
TE8 – ETI 122. Logic Tester
TE9 – ETI 124. Tone Burst Generator
TE10 – ETI 123. C Mos Tester
TE11 – ETI 116. Impedance Meter
TE12 – ETI 533. Digital Display 1975 Display
TE13 – ETI 117. Digital Voltmeter 1975 Display
TE14 – ETI 117. Digital Voltmeter 1976 Display
TE15 – ETI 704. Cross Hatch Dot Generator
TE16 – ETI 120. Logic Probe
TE17 – ETI 121. Logic Pulser
TE18 – ETI 118. Digital Frequency Meter 1975 Display
TE19 – ETI 118. Digital Frequency Meter 1976 Display
TE20 – ETI 222. Transistor Tester
TE21 – ETI 113. 7 Input Thermocouple Meter
TE22 – ETI 107. Wide Range Voltmeter
TE23 – ETI 108. Decade Resistance Box
TE24 – ETI 109. Digital Frequency Meter
TE25 – E.A. SWR Reflectometer
TE26 – E.A. R.F. Impedance Meter
TE27 – E.A. Antenna Noise Bridge
TE28 – E.A. 1968 Transistor Test Set
TE29 – E.A. 1971 Transistor (F.E.T.) Tester
TE30 – E.A. 1977 Digital Logic Trainer
TE31 – E.A. 2½ Digit Volt Ohm Meter
TE32 – E.A. Simple Function Generator
TE33 – E.A. Direct Reading Capacitance Meter
TE34 – ETI 487 Real Time Audio Analyser
TE35 – ETI 483 Sound Level Meter
TE36 – ETI 489 Real Time Audio Analyser
TE37 – ETI 717 Cross Hatch Generator
TE38 3 Megahertz Freq Counter
TE40 – E.A. Direct Reading Ohm Meter
TE41 – E.A. Function Generator

WARNING SYSTEMS

WS1 – ETI 583. Gas Alarm
WS2 – ETI 066. Temperature Alarm
WS3 – ETI 528. Home Burglar Alarm
WS4 – ETI 702. Radar Intruder Alarm
WS5 – ETI 220. Wailing Siren
WS6 – ETI 219. Hee-Haw Siren
WS7 – ETI 313. Car Alarm
WS8 – ETI 518. Door Monitor
WS9 – ETI 503. Electronic Thief Trap
WS10 – ETI 506. Infra Red Intruder Alarm
WS11 – ETI 305. Automatic Car Alarm System
WS12 – ETI 582. House Alarm
WS13 – E.A. Electronic Siren
WS14 – E.A. 1976 Car Alarm
WS15 – E.A. 10 Ghz Radar Alarm

PHOTOGRAPHIC

PH1 – ETI 586. Shutter Speed Timer
PH2 – ETI 548. Photographic Strobe
PH3 – ETI 514B. Sound Light Flash Trigger
PH4 – ETI 532. Photo Timer
PH5 – ETI 509. 50 Day Timer
PH6 – ETI 505. High Powered Strobe
PH7 – ETI 513. Tape Slide Synchronizer
PH8 – ETI 512. Photographic Process Timer
PH9 – ETI 515. Slave Flash
PH10 – ETI 540. Universal Timer
PH11 – E.A. 1970 Stroboscope Unit
PH12 – E.A. Sync-A-Slide
PH13 – E.A. Auto Trigger for Time Lapse Movies
PH14 – E.A. Digital Photo Timer

MODEL TRAIN UNITS

MT1 – ETI 541. Model Train Control
MT2 – E.A. 1974 Model Train Control
MT3 – E.A. 1971 S.C.R. P.U.T. Control Unit
MT4 – E.A. Electronic Steam Whistle
MT5 – E.A. Electronic Chuffer

AUTOMOTIVE UNITS

A1 – ETI 317. Rev. Monitor
A2 – ETI 081. Tachometer
A3 – ETI 316. Transistor Assisted Ignition
A4 – ETI 240. High Power Emergency Flasher
A5 – ETI 239. Break Down Beacon
A6 – ETI 312. Electronic Ignition System
A7 – ETI 301. Vari-Wiper
A8 – ETI 502. Emergency Flasher
A9 – ETI 302. Tacho and Dwell Meter
A10 – ETI 303. Brake Light Indicator
A11 – ETI 309. Battery Charger
A12 – E.A. 1970 C.D.I. Capacitor Discharge Ignition
A13 – E.A. High Efficiency Flasher
A14 – E.A. Dwell Meter
A15 – E.A. Variwiper
A16 – E.A. Tacho for Tune-ups
A17 – E.A. Ignition Analyser Tachometer
A18 – E.A. Strobe Adaptor for Ignition Analyser
A19 – E.A. 1975 C.D.I. Capacitor Discharge Ignition
A20 – E.A. Mains Supply for Car Cassettes
A21 – E.A. Automatic Heavy Duty Battery Charger

GUITAR UNITS

G1 – ETI 447. Audio Phaser
G2 – ETI 413. 2 x 200 watt Bridge Amplifier
G3 – ETI 424. Spring Reverb Mixer
G4 – ETI 408. Reverberation Unit
G5 – ETI 413. 100 watt Guitar Amplifier
G6 – ETI 410. A.D.U. for your Guitar
G7 – E.A. PM 125 50 watt Guitar Amplifier
G8 – E.A. PM 134 21 watt Guitar Amplifier
G9 – E.A. PM 138 20 watt Guitar Amplifier
G10 – E.A. Waa Waa Unit
G11 – E.A. Fuzz Box
G12 – E.A. Sustain Unit
G13 – E.A. PM 135 12 watt Guitar Amplifier

PREAMPLIFIERS AND MIXERS

P1 – ETI 445. Stereo Preamplifier
P2 – ETI 449. Balance Mic Pre-Amplifier
P4 – ETI 427. Graphic Equalizer
P5 – ETI 414. Master Mixer 8 Channel
P6 – ETI 419. Mixer Preamplifier
P7 – ETI 401. F.E.T. 4 Input Mixer
P8 – ETI 485. Graphic Equalizer
P9 – E.A. PM 127 Control Unit
P10 – E.A. Simple Mixer for Pick Up & Microphone
P11 – E.A. PM 145 Mixer

TUNERS

T1 – ETI 062. A.M. Tuner
T2 – ETI 740. FM Tuner
T3 – E.A. PM 138 Tuner
T4 – E.A. PM 146 AM-FM Tuner

VOLTAGE CURRENT CONTROLS

V1 – ETI 481. 12 volt to +40 VDC 100 watt Inverter
V2 – ETI 525. Drill Speed Controller
V3 – E.A. S.C.R. Speed Controller
V4 – E.A. Stage (etc.) Auto Dimmer 2 K.W.
V5 – E.A. Stage (etc) Auto Dimmer 4 K.W. & 6 K.W.
V6 – E.A. 1976 Speed Control

POWER SUPPLIES

PS1 – ETI 132. Experimenters Power Supply
PS2 – ETI 581. Dual Power Supply (High Powered Version)
PS3 – ETI 712. CB Power Supply
PS4 – ETI 131. Power Supply
PS5 – ETI 119. 5 Volt Switching Regulator Supply
PS6 – ETI 105. Laboratory Power Supply
PS7 – ETI 111. I C Power Supply
PS8 – E.A. D.C. Voltage Reference
PS9 – E.A. 1976 Power Supply
PS10 – E.A. Dual 30-2 0-30V @ 6A or 0-60V @ 3A
or Dual Pos and Neg 30V @ 3A
PS11 – E.A. CB Power Supply
PS12 – E.A. Dual Regulated Supply

RECEIVERS TRANSMITTERS

R1 – ETI 711. Remote Control Transmitter Switch
R2 – ETI 711R. Remote Control Receiver
R3 – ETI 711D. Remote Control Decoder
R4 – ETI 711B. Single Control
R5 – ETI711C. Double Control
R6 – ETI 711P. Power Supply
R7 – ETI 707A. 144MhZ Converter
R9 – ETI 708. Active Antenna
R10 – ETI 710. R.F. Power Amplifier
R11 – ETI 780. Novice Transmitter
R12 – ETI 703. Antenna Matching Unit
R13 – E.A. 1967 All Wave 7
R14 – E.A. 240 Communications Receiver
R15 – E.A. 110 Communications Receiver
R16 – E.A. 160 Communications Receiver
R17 – E.A. 130 Communications Receiver
R18 – E.A. All Wave I C 2
R19 – E.A. Deltahet Solid State Mk2 Communications Receiver
R20 – E.A. Fremodyne 4 Complete Kit
R21 – E.A. Fremodyne 4 RF Section
R22 – E.A. PM 138 Tuner-Receiver
R23 – E.A. Mos Fet 52Mhz Converter
R24 – E.A. 2-6Mhz Converter
R25 – E.A. 8-19Mhz Converter
R26 – E.A. 100Khz Crystal Calibrator
R27 – E.A. 1Mhz Crystal Calibrator
R28 – E.A. V.H.F. Power Match
R29 – E.A. Short Wave Converter for 27Mhz
R30 – E.A. Simple S.W.R. Meter
R31 – E.A. 27Mhz Pre-Amp
R32 – E.A. 10-30Mhz Pre-Amp

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C1 – ETI 633. Video Synch Board
C2 – ETI 632M. Part 1 Memory Board V.D.U.
C3 – ETI 632P. Part 1 Power Supply V.D.I.
C4 – ETI 632A. Part 2 Control Logic V.D.U.
C5 – ETI 632B. Part 2 Control Logic V.D.U.
C6 – ETI 632C. Part 2 Character Generator V.D.U.
C7 – ETI 632. Mother Board inc. P S
C8 – ETI 632U. (U.A.R.T.) Board
C9 – ETI 631-2. Keyboard Encoder
C10 – ETI 631. A. Sch. Keyboard Encoder (less keyboard)
C11 – ETI 670. Hex Display
C12 – E.A. Educ-8 Computer
C13 – E.A. Cassette-Tape Interface

MISCELLANEOUS KITS

M1 – ETI 604. Accentuated Beat Metronome
M2 – ETI 546. G.S.R. Meter
M3 – ETI 549. Induction Balance Metal Locator
M4 – ETI 547. Telephone Bell Extender
M5 – ETI 602. Mini Organ
M6 – ETI 544. Heart Rate Monitor
M7 – ETI 044. Two Tone Doorbell
M8 – ETI 043. Heads or Tails
M9 – ETI 068. L.E.D. Dice Circuit
M10 – ETI 539. Touch Switch
M11 – ETI 529. Electronic Poker Machine
M12 – ETI 236. Code Practice Oscillator
M13 – ETI 218. Monophonic Organ
M14 – ETI 701. Masthead Amplifier
M15 – E.A. I C Volume Compressor
M16 – E.A. Geiger Counter
M17 – E.A. Electronic Anemometer
M18 – E.A. 240 Volt Lamp Flasher
M19 – E.A. A C Line Filter
M20 – E.A. Bongo Drums
M21 – E.A. Keyless Organ
M22 – E.A. Auto Drums
M23 – E.A. Electronic Roulette Wheel
M24 – E.A. Video Ball Game
M25 – E.A. Digital Metronome
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M27 – E.A. Gas Detector
M28 L.E.D. Chaser
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Novel constructional project:

A Receiver Built Into Headphones

Here is a project which, in the early days of radio, would have been regarded as pure science fiction: a full-scale superhet broadcast-band receiver built into a pair of headphones, complete with aerial and battery. You can put it together from a readily available kit in a couple of evenings.

by WALTER NEVILLE

As a novelty project, the receiver-in-headphone will provide an immediate conversation piece, as well as providing a practical exercise for those who may need to develop their skills in this direction. However, it doesn't end there; it is also a very useful project.

The basic receiver is equivalent in performance to the average miniature portable superhet, and normally capable of receiving all the broadcast stations in each local area — plus others on the fringe, or at night. However, for personal listening, the sound quality from the full sized headphones involved is far better than from the usual miniature earplug, which only feeds one ear, anyway!

While the finished unit should be excellent for personal listening in the home, members of our staff were not slow to suggest other uses for it: to follow the football when gardening on Saturday afternoons, or as ear-muffs-with-radio when mowing the lawn.

All the parts necessary for the project are available as a boxed Archerkit, sold in Australia by Tandy stores (Catalog number 28.4021, $16.95). The only additional item needed to make it operative is a miniature 9V transistor battery.

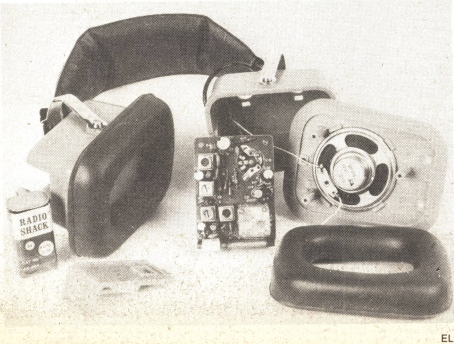
Boxed with the kit are three pieces of literature: a small "Kit Kues" brochure to help beginners with their soldering and in the identification of components: a parts list to allow the contents of the kit to be checked over; and a brochure specifically for the 28-4021 kit, giving general hints, a step by step assembly procedure and alignment instructions.

Everything is set out very plainly, with illustrations, and it may indeed be possible for someone who has never before seen the inside of an electronics gadget to put it together successfully. However, to learn to identify, handle and solder miniature components all at one step would be quite an assignment and aboslute beginners would be well advised to proceed very slowly and, if at all possible, to try to find someone to ask, if there is any area of uncertainty.

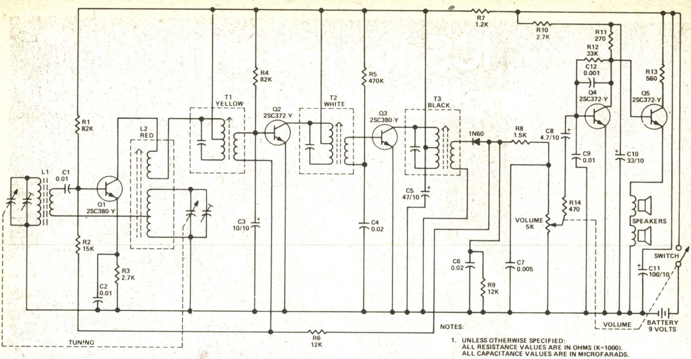
No cutting or drilling is required, so that the kit could be put together as successfully on one end of a kitchen table as on a proper workbench. You will need good local lighting, however, e.g. a table lamp, and possibly a magnifying reading glass to permit detailed inspection of the components and soldered joints.

By way of tools, a small soldering iron is essential, preferably one with a bit of about 4mm diameter, tapering down to a narrow wedge point. A length of small gauge cored solder is included in the kit.

If you're the proud owner of a 60W iron that has served you, man and boy,



The completed project is shown at the top of the page while, at left, the various components are exposed.



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
ALL RESISTANCE VALUES ARE IN OHMS (K=1000).
ALL CAPACITANCE VALUES ARE IN MICROFARADS.
2. ELECTROLYTIC TYPE CAPACITORS INCLUDE VOLTAGE RATING.

Here is the complete circuit diagram, reproduced directly from the Archerkit manual. The function of the various stages is explained in the article.

for 30 years, along with heavy solder and a pot of flux, forget it, in terms of modern PC boards.

A small iron, a steady hand and good visibility are essential with modern projects and, while the 28-4021 headphone radio is not nearly as demanding as more complex equipment, it must at least be regarded as a stepping stone in that direction.

Other tools you will require are more or less standard items for the electronic hobby bench: a pair of sidecutters, pointed pliers, a pair of tweezers and a suitable screwdriver. The screws involved in the kit are tiny self-tappers with Philips style heads. Lacking a matching driver, we used a plain one out of a set of instrument maker's screwdrivers, which we keep around.

As to the actual construction, it is only a matter of followig the instructions in the booklet step by step, ticking each check box as you go along. Inspect each joint as you make it, watching out particularly for blobs or whiskers of solder bridging to adjacent copper tracks.

For those who are interested in how a superhet receiver like this works, we have reproduced the circuit diagram directly from the instruction book. Let's follow it through, step by step.

Incoming signals are picked up directly by L1, a so-called aerial coil wound on a flat ferrite rod. The coil is tuned to the desired station frequency by one section of a two-gang variable capacitor — shown with an arrow drawn through it, and connected by a dotted line to the second section of the same tuning gang.

To allow the tuning to be peaked accurately, two adjustments are provided: a small "trimmer" capacitor is connected across the tuning capacitor (actually an integral part of the assembly) while the inductance of the aerial coil can be varied by sliding it along the ferrite rod. The actual procedures are explained in the instruction book under the heading of "Alignment".

From the aerial coil, the selected signal passes to the base of the first transistor Q1.

In fact, Q1 is not just a simple transistor amplifier. The base circuit and the collector circuit are connected to a double-wound coil L2 in such a way that Q1 is made to oscillate, thereby generating a signal of its own. This is mixed (or "heterodyned") with the incoming station signal, so that Q1 is referred to as a "mixer-oscillator".

As an essential feature of the design, the locally generated frequency is arranged always to be 455kHz above the frequency which is being admitted to Q1 through the aerial coil L1. The frequency difference is established and maintained by tuning the oscillator coil L2 with the second section of the tuning gang already referred to — plus two further alignment facilities, an oscillator "trimmer" capacitor and a slug in the oscillator coil to vary its inductance.

Because of the mixing action in Q1, a new "intermediate" signal appears in its collector circuit, at 455kHz, equal to the difference between the incoming station frequency and the local oscillator frequency. What is more, this new "intermediate frequency" is always the same, no matter what station the set is tuned to, because the tuning system maintains precisely that frequency difference.

T1 is an "intermediate frequency" or "IF" transformer, permanently tuned to 455kHz, so it passes the new signal to Q2. Here it is amplified and passed on by a second IF transformer to transistor Q3 and thence through a third IF transformer to a 1N60 detector diode. All three of th IF transformers have adjustable slugs by which they can be aligned exactly to 455kHz, and this is also covered under the alignment instructions.

Happily, the IF signal at 455kHz retains the modulation (or audio information) that was on the incoming station signal. Thus, the 1N60 detector diode can recover the original sound signal, which passes via resistor R8 to the 5k volume control. Depending on the setting of the control, a proportion of the recovered audio signal passes through resistor R14 to the base of Q4, the first of two audio amplifier stages.

The second audio amplifier transistor Q5 delivers its signal to the two small loudspeakers, one mounted in each headphone. Because the loudspeakers are held right against the ears, the power output required is quite modest and Q5 can deliver all that is required for a total battery drain of about 12mA from the 9V source.

One other point about the circuit is worthy of explanation: as well as the audio signal voltage, the 1N60 diode tends to produce a DC voltage proportional to the strength of the incoming signal. This DC voltage is fed back to the base of Q2 through R6, and on to Q1, having the effect of reducing their amplification (or gain) in the presence of strong signals. The system is known as "automatic gain control" or "AGC".

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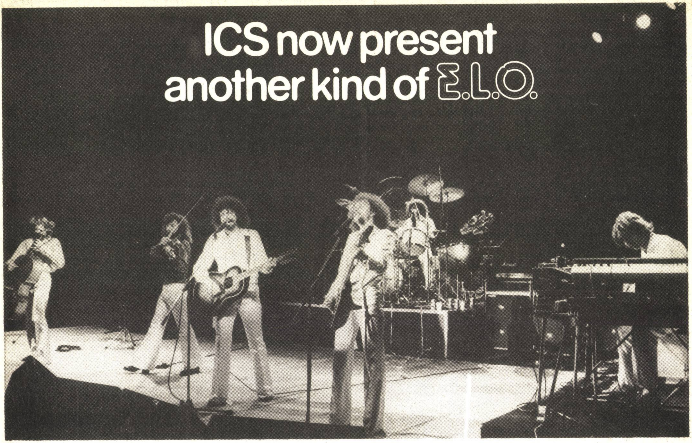

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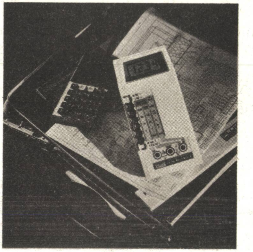

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by DAVID EDWARDS

The conventional way of measuring the rotational speed of shafts and fans, etc, is to use a stroboscope — a flashing light source incorporating analog metering circuitry to display the flash frequency. Although stroboscopes can be quite accurate, they nevertheless require a degree of skill on the part of the operator, if the readings are not to be misinterpreted.

The accuracy and readability of a stroboscope can be improved by replacing the analog scale with a digital readout. This involves measuring and displaying the flash frequency on a "dedicated" digital frequency meter (DFM) — one especially designed to register in terms of pulses per minute, rather than per second.

Working on the assumption that, by now, many readers will own or have access to a conventional digital frequency meter, it seemed wasteful to have a second such unit tied up as a dedicated instrument. This turned our thoughts towards some type of add-on unit which could be used with what they already have.

Unfortunately, this approach precludes a direct readout in rpm, due to the difficulty of implementing a reliable wide range times-60 frequency multiplier. In a dedicated instrument, the equivalent result is achieved by inserting a divider in the timebase divider, but this approach is impractical with an add-on unit.

It means that an add-on unit, using a DFM, can only display speeds in revolutions per second rather than rpm, and some mental arithmetic is called for.

Rather than build a stroboscopic add-on unit, we opted, on the grounds of economy, for a passive add-on unit, using variations in ambient or applied illumination to sense the rotational speed of the shaft or fan.

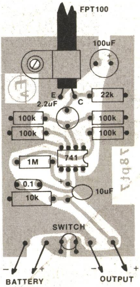
A phototransistor is used to sense changes in light intensity. This can be caused in two basic ways, by interruption or by reflection.

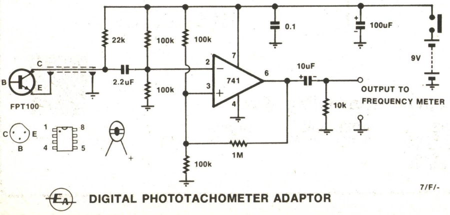
In the interruptive mode, a fan or similar "chopper" is placed between a light source and the phototransistor. Everytime a blade comes between the two, a pulse is generated by the phototransistor. The rate at which these pulses is generated will depend on the rotational speed of the fan, and also on the number of blades.

The reflective mode relies on a difference in contrast between different sectors of the rotating object. Imagine a shaft with one side painted black and one side painted white. If a light is directed so that it shines onto the shaft, and if the phototransistor is placed so that it can see the reflected light, then a pulse will be generated each time the white (reflective) portion of the shaft passes.

The pulses generated by the phototransistor will in general be low in amplitude, and have poor rise and fall times, and are not suitable for direct coupling to a DFM. A 741 op amp, wired as a Schmitt trigger, is used to square up and buffer the pulses.

In order to render the unit insensitive to ambient light variations, the signal from the phototransistor is AC coupled into the 741. AC coupling is also used at





DIGITAL PHOTOTACHOMETER ADAPTOR

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The complete circuit diagram of the unit is shown on the left, while the component overlay diagram is reproduced above. Note the cable clamp.

the output. The unit is powered from a small 9V battery, so that a complete probe assembly can be made.

As you can see in the photographs, we assembled the circuit on a small printed circuit board. A discarded ball-pen case is used as a collimator for the phototransistor, which is mounted about 25mm from one end of the tube. This tube must be opaque, and this can be achieved by wrapping it with black electrical tape.

The tube is clamped to the board by means of a plastic cord clamp. The screw used for this is also used to support this end of the board away from the aluminium lid of the box.

We used one of the smaller "zippy" boxes for the prototype. Overall dimensions of the box we used were 103 x 54 x 41mm. A momentary contact pushbutton is used as the power switch. This is mounted in the lid of the box, and is used to support the remaining end of the PCB.

Connection to the DFM is made with a length of shielded cable. The free end of this should be fitted with the appropriate connector required by your counter. The cord exits through a small hole in the box, with a knot used for strain relief.

A clearance hole is provided at the other end of the box so that the phototransistor tube assembly can be passed through it. With the box specified, the battery and clip are a tight fit in the bottom of the box, and do not need any other support.

Testing of the completed probe assembly is best carried out by a trial test. One of the larger domestic fans is a good source of suitably chopped light. Connect up the probe to your DFM, and position a light on the other side of the fan. With your finger over the end of the collimating tube, the counter shoul read zero.

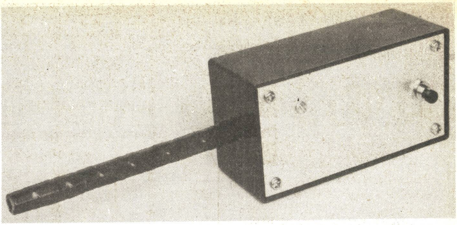
Now point the tube at the light, with the rotating fan blades interspersed, and you should be rewarded by a reading on the DFM. This should equal the rotational speed of the fan in rpm divided by 60, and multiplied by the number of blades.

Thus the reading for a four bladed fan rotating at 450 rpm would be 30. Once you have achieved correct operation in the chopped mode, try out the reflective mode. This can be achieved with a painted shaft as described earlier, or with a suitably coloured sanding disc in an electric drill.

Remember that for best results, the angle of incidence of the light onto the surface should be such that it is reflected directly into the tube of the probe.

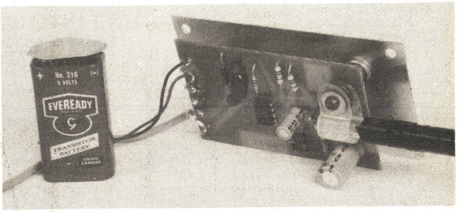
Our tests of the prototype showed that reliable performance could be achieved up to at least 60,000 rpm for a single bladed fan. This corresponded to 7,500 rpm of the eight bladed fan we were using, and a display of 1000 on the DFM. At this speed, our nerves gave out, so we did not test at any higher speeds.

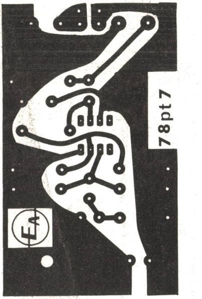
The higher speed performance of the circuit is mainly limited by the response time of the phototransistor. The 741 should be capable of switching at rates in excess of 10kHz, corresponding to 600,000 rpm for a single bladed fan!



ABOVE: The way in which the probe assembly protrudes from the "zippy" box can be seen in this photograph.

BELOW: Note how the ball-pew case is clamped to the PCB, and the PCB to the lid of the box, using a tapped spacer.





Here is a full-sized reproduction of the PCB pattern.

PARTS LIST

- *1 741 operational amplifier (minidip package)*
- *1 FPT100 photo-transistor*
- *1 100uF 16VW PCB mounting electrolytic capacitor*
- *1 10uF tantalum electrolytic capacitor*
- *1 2.2uF bipolar electrolytic capacitor*
- *1 0.1uF polyester capacitor*
- *1 1M, 4 100k, 1 22k, 1 10k ¼W resistors*
- *1 9V battery, Eveready 216 or similar*
- *1 battery clip to suit*
- *1 printed circuit board, 46 x 76mm, coded 78pt7*
- *1 "Zippy" box, 103 x 54 x 41mm*
- *1 cable clamp*
- *1 12mm tapped spacer and 2 machine screws to suit*
- *1 miniature momentary contact pushbotton switch*
- *1 metre shielded cable*
- *1 used ballpen case (see text)*
- *Solder, hookup wire, PCB pins, insulation tape*

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.

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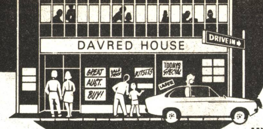

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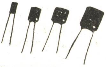

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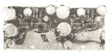

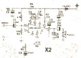

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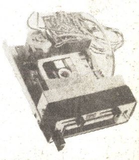

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The Serviceman

Puzzling faults which cannot be pursued...

One of the minor frustrations of service work is that one is not always able to nominate the exact reason why a fault in a certain component produces a particular set of symptoms. And, the pressures of business being what they are, it is not always possible to spend the time necessary to find the answer.

As I may have mentioned on previous occasions, a serviceman doesn't make his living from the kind of stories I relate in these notes. The hard ones, or the ones that have trapped someone else, may be very good for the ego when you crack them, and even enhance one's reputation, but they do nothing to help run the Rolls Royce.

No, its the routine faults, the ones you've seen a dozen times before, that puts the fruit on the sideboard. (I don't really own a Rolls Royce!) Unfortunately, every now and again one gets trapped by a routine fault that isn't; a perfect set of symptoms but a completely different fault. And you don't make much money out of those, either.

This story is typical. The set was a 17in monochrome set; a model I had handled many times before. The symptoms were also familiar; no picture, no raster, and all the signs of a completely dead line output stage.

A quick visual inspection in this part of the set revealed a symptom I had seen many times before; a badly overheated 10 ohm, 5W resistor which supplies the line output stage. I went through the motions of checking it with a multimeter, but the result was a foregone conclusion; it was open circuit. At this point I reckoned I could nominate the fault within two components; either the boost capacitor had shorted, or the line output transistor had broken down.

The capacitor is the easier item to check, so I tried it first and found that it was quite OK. That left the transistor, and it did not take long to confirm that it was broken down between collector and emitter.

Congratulating myself on my perspicacity I cheerfully fitted a new transistor and a new 10 ohm resistor, switched on, and waited for the picture to come up. It didn't, and at about the same time I realised it wasn't going to, I also realised that smoke was pouring from the new 10 ohm resistor. I grabbed frantically at the switch but it was too late; I had another dud resistor and transistor on my hands.

Somewhat taken aback, I fished out another resistor and transistor and fitted them, except that, on an impulse, I held off completing the collector connection to the transistor. I had no desire to sacrifice another one and, at this stage, I had no idea what had caused the second one to fail. Best play it safe until I had made some other tests.

I went over the line output stage and checked everything I could think of; resistor values, transformer windings, etc, but I could find nothing wrong. Finally I switched the set on again and reached for the CRO leads. Using these it didn't take long to turn up a clue, although its full significance was not immediately obvious. All I knew at that stage was that there was no drive at the base of the line output transistor.

Checking the driver stage showed that there was no signal here either. The next stage was the oscillator, and it was also dead.

At this point I put the CRO leads aside and reached for the meter leads; I reasoned that, with a failure as complete as this, there would just have to be a DC condition associated with it. Sure enough, there was no voltage to be found on the oscillator transistor.

This is fed from the supply rail via a 1.5k decoupling resistor, and it didn't take long to discover that this latter component was open circuit. Replacing it brought everything back to life up to the base of the line output transistor, and completing its collector connection put a picture on the screen.

Which was all very well as far as getting the set back to customer was concerned, but left unanswered one very important question; why did the second output transistor fail? (Or the first one, for that matter?)

The question was important for two reasons. First, the failure might imply a more subtle fault which I had overlooked — and which could rebound to my discredit within hours of the customer paying his account. Secondly, and somewhat less importantly, I just don't like loose ends of this kind.

On the other hand, one has to be realistic. There is a limit to the time one can spend sorting out mysteries like this. Provided the set continued to perform satisfactorily for a reasonable time, I had no option but to return it to the customer and keep my fingers crossed.

Which, in fact, is what I did and there has been no rebound yet. But why did the transistor fail? It is all too easy to suggest that it was the drive failure that caused the transistor failure but, in my book, this just won't wash.

The circuit around the line output transistor is relatively simple in this set. The emitter connects to chassis, the collector is fed from a regulated rail — via the line output transformer winding and the 10 ohm resistor — and the base is fed with signal from the line oscillator via a coupling transformer. In the absence of any signal at the base there appears to be no way that it could draw any current at all, let alone a destructive one.

The only explanation I can offer is that the replacement transistor, although new, was faulty. This doesn't happen very often, but it has happened.

So there it is; if anybody has a better suggestion I would be happy to hear it.

The next story concerns a 12in AWA monochrome set using a P17 chassis. This one was completely dead and a multimeter check showed that there was no voltage on the main 11V rail.

The easiest component to check in such cases is the regulator transistor, a 2SD155 (TR26). This is mounted on its own heatsink and connects to the main board via a short lead and plug. It is quite simple to withdraw the plug and check the transistor without using the soldering iron.

It isn't often that the easiest component to check proves to be the faulty one — Murphy sees to that — but it was so on this occasion, and a new transistor put a picture back on the screen.

In the ordinary way that would have

been the end of the story and it wouldn't have been worth writing about. Fortunately, the channel the set was tuned to was transmitting a test pattern and, while it looked all right superficially, I suddenly realised that there was no castellation pattern on the left hand side. In its place was a plain grey area.

Well, this was one I definitely hadn't seen before, but I reasoned it just had to be a scan fault of some kind. Happily, the line output stage is a relatively simple one and it didn't take me long to track down an open circuit 220uF electrolytic decoupling capacitor (C516). This, in conjunction with a 50uH choke, is intended to keep line pulses out of the 11V rail.

Replacing it cured the problem, but I must confess that I am still not quite sure of the mechanism by which the symptoms were produced. And, as I said before, there is not always time to probe into such mysteries as deeply as one would like.

Assuming that the retrace waveform contained some kind of a pulse which coincided with this part of the trace, it does seem possible that this could find its way, via the 11V rail, into the video stages, or even the IF stages. The result could be a momentary blanking of the video information.

This is all speculation of course, but I have made a note to keep my eye open for similar symptoms on any future models of this set which I handle. If I strike it again I may have a better chance to follow up the theory.

And here is a quickie to finish off. It is not often that customers correctly diagnose their own equipment problems — let alone fix them — and it is rarer still for me to get a laugh out of such a situation, but this was one such case.

It concerns an expensive imported European colour TV set, featuring touch tuning. The owner was very happy with it until, one summer's night, it suddenly started changing channels spontaneously.

At that point in the story I was mentally going over the circuit and trying to visualise what might possibly cause such an effect and, believing at this stage that I would have to service the set, just where I would start.

It came as a horrible let down, therefore, when the customer explained that he had found the cause and fixed it. A beetle had decided to take up residence on the touch plate and was wandering up and down over the contacts. Apparently the system was quite sensitive enough to respond to such a small presence, much to the annoyance of the owner.

I'm afraid my laughter was as much one of relief as of straight out amusement. Had the owner not realised what had caused it, and called me in, I would have been led a merry chase.

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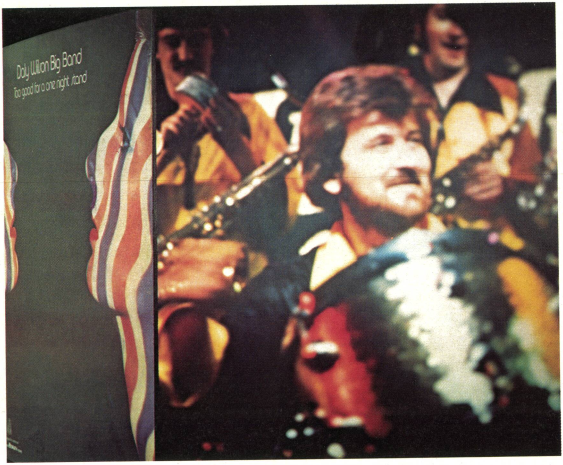
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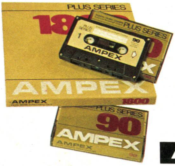

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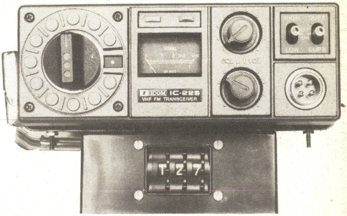
Extra channels for the ICOM IC22S

In our last article we described how to modify an Icom IC22S two-metre transceiver to permit the use of external channel selection systems, plus a simple switching system to go with it. As promised, this article discusses the use of thumbwheel switches in a somewhat more elaborate system which has a number of advantages, including easier identification of signals.

by PHILIP WATSON



The thumbwheel switch assembly mounted underneath the transceiver. The switches are housed in a small plastic box which is attached to the lower half of the mobile mounting bracket.

The switches are the real secret of this idea, and a few words about them may help the reader who has not encountered them before. Quite apart from the thumbwheel action, they are known as BCD (Binary Coded Decimal) switches.

They are 10 position switches, coded "0" to "9" and, for any decimal figure to which they are set, they provide the equivalent binary connections between their common and four active terminals (designated 1, 2, 4, 8,).

For example, when the switch is set to "1" the common is connected to terminal "1"; when it is set to "2" it connects to terminal "2". When it is set to "3" the common is connected to both terminals "1" and "2", thus satisfying the binary combination for "3". The same applies for all figures up to "9" (8 + 1).

While, at first glance, it may appear that a suitable combination of such switches could be made to receive "N" numbers and convert them to the binary equivalent, there is no easy way to do this using simple passive circuitry.

What can be done is to treat the switches as octal rather than decimal devices and replace the "N" numbers with a table of octal numbers. For those not familiar with the octal numbering system it uses the digits "0" to "7", rather than "0" to "9" as in the decimal system. The result can be seen in the "octal" column in the chart presented in the previous article.

The thumbwheel switches can be obtained in modified form for the octal system, the modification being simply the addition of stops to limit the travel to eight positions. Electrically, the fourth terminal (8) is ignored.

For our purpose the mechanical stops would seem to be a disadvantage. For one thing they increase the cost per switch section but, more importantly, they make the switch less convenient to use. Having progressed from "0" to "7", it is then necessary to retrace these positions to come back to "0" in anticipation of the next octade.

With the switches in their original form, it is much easier to move forward over positions "8" and "9" — which can be ignored — reaching "0" in three movements instead of seven. The only minor objection to this is the fact that positions "8" and "9" duplicate positions "0" and "1" electrically and this may be confusing the first time it is encountered.

	Signals Connected To Common Signal C				
Wheel	1	2	4	8	C
0					
1	●				●
2		●			●
3	●	●			●
4			●		●
5	●		●		●
6		●	●		●
7	●	●	●		●
8				●	●
9	●			●	●
	3	5	7	11	9
	TERM. LOCATION				

A truth table from the C&K catalogue showing the internal binary connections against the external decimal settings.

(It is possible to erase the unwanted figures, using a pencil type typewriter eraser. Be aware, however, that there is a risk of the resultant rubbish finding its way into the switch contacts. Also, in the event that a more elaborate circuit is subsequently employed, these figures may regain their validity.)

The switches are the C&K brand, handled in Australia by C&K Electronics (Aust.) Pty Ltd (6 McFarlane St, Merrylands, NSW) and from them to various distributors. We obtained our unit from Radio Despatch Service, who advise that they have good stocks.

These are professional switches and, as such, are somewhat dearer than conventional switches. The three section unit used in this project will cost around $12.00. If this seems expensive, remember that it is the main cost and that, even after providing a plastic box, cable, diodes etc, the total cost will probably be less than that of a couple of sets of crystals as needed for older style transceivers.

Mechanically, two styles are available; front mounting and rear mounting. The front mounting type is simply pushed into an appropriate size cut-out in the panel, and is retained by plastic clips moulded into the body. The rear mounting type mounts behind

Extra channels for the IC22S — Cont.

an appropriate cut-out and is held with four small machine screws.

An advantage of the front mounting type is that the cut-out, while needing to be reasonably accurate, does not require a professional finish, since it is hidden by the switch. Against this, we were somewhat concerned that the plastic box might be too thick to engage the retaining clips properly. Also, this switch is marginally deeper than the rear mounting type.

While the rear mounting type needs more care in preparing the cut-out, we chose this type, and managed to make a reasonably neat job of fitting it. Six mounting holes are provided but four would seem to be adequate. The size of the cut-out given in the manufacturer's data is 25.91mm (H) x 35.31mm (W) although the one we cut was slightly smaller.

The mounting screws will need to be smaller than the common ⅛in Whitworth, and 8BA would be better. Note that there is little point in enlarging the holes, since there is insufficient room for a standard ⅛in nut.

We built our version in a UB4 Jiffy box and, while there is not a lot of room to spare, it is adequate. We mounted the diodes on a piece of miniature tag board, 10 terminals long, which mounts against the rear of the box, but spaced away from it by the thickness of a nut. The tag board is a little too wide to be accommodated in the depth of the box, so the lugs were bent at right angles.

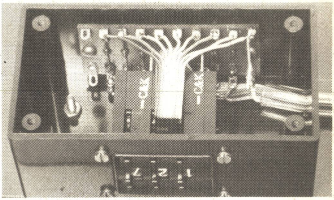
The cable is wired to the lower lugs and dressed so as to exit from the left hand side of the box, to match the location of the 9-pin socket on the back of the set. We enclosed the cable in about 50mm of clear plastic tubing, 8mm OD, 5mm ID, where it emerges from the box. This helps secure it, using a cable clamp if necessary.

Wiring between the upper terminals of the tag board and the switch is via a short length of rainbow cable, long enough to allow the switch to be removed. Wire the switch first, retaining the correct colour code, then fit the switch and complete the wiring. The surplus cable can lay flat on top of the switch.

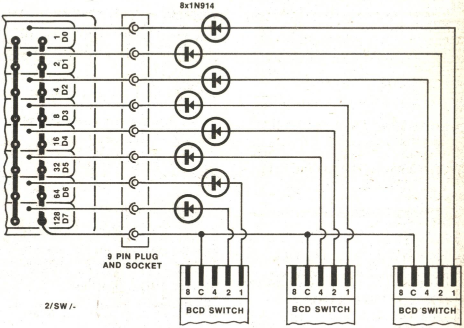
Having used both the slide switch arrangement and the thumbwheel switches, there is no doubt that the latter arrangement is much to be preferred and well worth the few extra dollars involved.

Exploring the band — or, at any rate, portions of the band — is now practical, and without the need to concentrate too much on the exact frequencies involved until a signal is heard. Then it is only a matter of transferring the thumbwheel figures to the table in order to identify it.

Nevertheless we have encountered a number of enthusiasts on the air who have fitted slide or toggle switch assemblies, and who are perfectly happy with them. And at least two have come up with interesting variations on the basic theme.



Interior of the plastic box showing the location of the terminal board for the diodes and the wiring between it and the switch. Note the cable leaving the box on the right.



While the circuit itself is quite simple, this diagram provides useful information concerning the connections to both the matrix board inside the set and the terminals on the BCD thumbwheel switches.

One used only seven switches, on the basis that he needed only 50kHz steps for the present band plan. (The binary "1" switch is simply omitted.) Since the saving in cost of one switch is hardly significant, the main advantage would seem to be that it simplifies the switch combinations.

The other idea was to fit small LED indicators above each switch, arranged to come on when the switch was activated. This was done by using the second and otherwise redundant pole on each switch to connect the LED, via a suitable current limiting resistor, to a 12V rail.

The 12V was brought out of the set via an extra conductor and this was beyond the capacity of the 9 pin socket. In fact, the socket was not used at all, in the electrical sense, the 10 conductor cable being brought out unbroken through the hole in the socket and wired directly to the switching system. This amateur uses the external switches almost exclusively, " . . . to save wear and tear on the switch in the set".

The two options, (c) and (d), mentioned in the first article are merely suggestions which readers might like to consider as a possible solution to a particular problem. They have not been tried.

But whether you use toggle switches, thumbwheel switches, or cook up something of your own, perhaps inspired by these articles, you will find that it provides a gratifying sense of freedom. You are no longer tied to the channels in the set, nor need you worry about future band-plan changes. Whatever happens you can cope with it.

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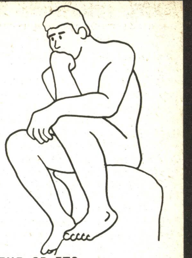

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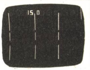

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DICK SMITH ELECTRONICS

Two 5/8-in-phase antenna for 2 metres

With the ever increasing interest in the two-metre amateur band, particularly with FM and the repeaters, the need for more efficient vertically polarised antennas is on the increase. Here is an antenna which would be suitable for fixed installations and which gives quite a low angle of radiation, with its attendant advantages.

by IAN POGSON

After an absence of many years from the two-metre amateur band, I decided that it was time to put in another appearance. Having acquired the necessary receiving and transmitting equipment, the question of a suitable antenna arose. In days gone by, horizontal polarisation was almost universal on two metres. However, with the proliferation of the mobile use of the band, it became desirable to use vertical polarisation for the convenience of mounting suitable antennas on vehicles. So, the search began for a suitable vertically polarised antenna.

Various types of the simpler vertical antennas were tried, including the coaxial dipole, a variation on the folded dipole and a five-eighth vertical. Each one gave results more or less in accordance with what one would expect. However, the challenge of the more distant repeaters had already attracted my attention. Some could be heard at low signal strength but I could not trigger them; hence the challenge.

Obviously, higher power or a better antenna was required. The former was ruled out and so a higher gain antenna was indicated. The higher gain could be obtained by lowering the angle of radiation on an omnidirectional antenna or by erecting a multi-element beam. The fixed omnidirectional approach was favoured on the grounds of mechanical simplicity when compared with the requirements for rotating a beam. Also, I favoured a type of vertical antenna without the use of radials.

In my presence and at just the right time, the term "two five-eighths in phase" was mentioned. This triggered my thinking and brought me back to the well known "extended double zepp" antenna, which has been used for many years on the high frequency bands.

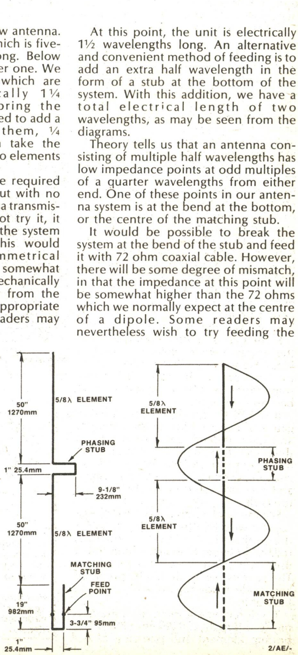
A suitable design was worked out on paper, using well-used principles. Let us start at the top of the new antenna. We provide one element which is five-eighths of a wavelength long. Below this element, we add another one. We now have two elements, which are stacked and electrically 1¼ wavelengths long. To bring the elements "in phase", we need to add a phasing stub between them, ¼ wavelength long. This can take the form of a stub joining the two elements together.

At this stage, we have the required two five-eighths in phase but with no provision to feed them from a transmission line. Although I did not try it, it should be possible to feed the system from the phasing stub. This would provide a desirable symmetrical feedpoint but one that is somewhat messy, in that it is difficult mechanically to bring the feedline away from the aerial at right angles for an appropriate distance. Even so, some readers may like to try this method.

At this point, the unit is electrically 1½ wavelengths long. An alternative and convenient method of feeding is to add an extra half wavelength in the form of a stub at the bottom of the system. With this addition, we have a total electrical length of two wavelengths, as may be seen from the diagrams.

Theory tells us that an antenna consisting of multiple half wavelengths has low impedance points at odd multiples of a quarter wavelengths from either end. One of these points in our antenna system is at the bend at the bottom, or the centre of the matching stub.

It would be possible to break the system at the bend of the stub and feed it with 72 ohm coaxial cable. However, there will be some degree of mismatch, in that the impedance at this point will be somewhat higher than the 72 ohms which we normally expect at the centre of a dipole. Some readers may nevertheless wish to try feeding the



Dimensions of the new antenna are shown at right, together with a graph showing the current distribution in the system. Prototype was made from brass tubing and 14 gauge copper wire.

antenna this simple way. The braid of the coax. should be connected to the short side of the stub, with the centre of the coax. being connected to the side of the stub which is directly connected to the bottom radiating element.

In the writer's opinion, a better way to feed the antenna is to leave the stub unbroken and to make use of a coaxial balun with a step-up impedance of four. This means that the feedline impedance will be stepped up to about 288 ohms, when using 72 ohm cable; the end of the feedline is also balanced, which is an advantage. The balanced feedline is tapped across the matching stub at a distance above the bend, such that a good match is obtained.

Let us take another look at the diagram showing the current distribution on the whole system. The two five-eighth radiating elements are shown in full lines. The quarter wave matching stub between the elements is shown dotted. Below the lower element is the matching stub which is an electrical half-wave long and this is also shown dotted.

It should be noted that the two half waves on the radiating elements are in phase although, at the ends nearest the phasing stub, there is a small amount of current in each case which is out of phase. The amount of current in these portions is not great and does not materially affect the overall performance of the system.

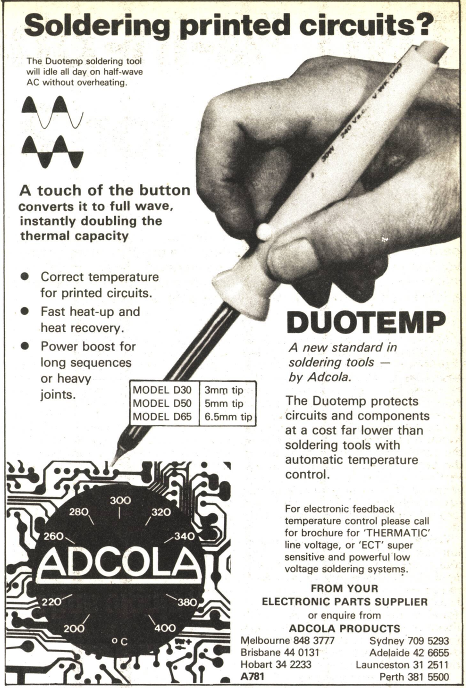
When two half waves are fed in phase, with adjacent ends close together, a gain of nearly 2dB is realised. However, if the adjacent ends, and so the two elements are separated, an increase in gain is realised. This can be done by extending the element lengths, as we have already done. There is a limit to this when each element is 0.64 of a wavelength long, or a little over five-eighths. At this point, the gain over a dipole is about 3dB. And so our new antenna may be considered as having this order of gain over a dipole.

From a constructional point of view, the device is wide open to individual ideas. However, I will describe the way I went about it and add some suggestions as to how my efforts may be improved upon.

It would be possible to use a heavy gauge of copper wire for the elements and stubs. Indeed, this is what I did in the initial stage, before making it up in its present form. While the wire idea is cheap and quick, it is not very rugged and may not stand up to the weather too well.

For the final antenna I used 14 gauge copper wire for the phasing stub. For the remainder of the conductors, radiating elements and matching stub, I used ¼in OD thin walled brass tubing. The various pieces should be prepared and made ready for assembly into the final unit.

The top element is cut from the tubing to a length of 1290mm (50in). The bottom element and one side of the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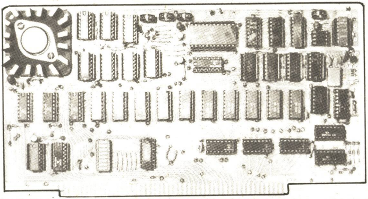

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Two 5/8 in-phase antenna for 2 metres . . .

matching stub forms another piece and this is cut to a length of 1753mm (69in). The other side of the matching stub is cut to 483mm (19in). Incidentally, it is a good idea to make the last two dimensions about another 12mm (½in) longer than the figures just given. More will be said about this later on. The phasing stub is formed from a piece of about 14 gauge wire into the shape of a "U", with legs 232mm (9-1/8in) long and with a spacing of 25.4mm (1in). As before, the legs may be made say another 25mm longer than suggested and this will be taken care of later on.

In order to make an assembly of the various components, I used an 8ft length of ¾in diameter wooden dowel and five nylon cup hooks with brass screws. The cup hooks have an inside diameter of about 25mm and automatically provide low loss insulation for the antenna elements. Before use, the wooden dowel should be primed and painted so that it will stand up to the weather.

By allowing a bit less than one metre of the top element to protrude above the wooden dowel, it is possible to get the rest of the items along the dowel, with sufficient dowel left over at the bottom to allow for mounting it atop a piece of water pipe or whatever you may choose for the purpose.

With the individual components now ready, take the painted wooden dowel and screw the nylon hooks into position along the dowel. Start with one about 15mm from the top. The next one will be about 300mm lower, such that it is a little above the junction of the top radiator and the phasing stub. The next will be at a point equally distant from the corresponding junction of the lower radiator and the phasing stub. The next hook is placed just below the open end of the matching stub, and the last one just above the feed point.

The cup hooks should all be in a straight line along the dowel and they should all be pointing in the one direction, at right angles to the dowel. This makes them ready to have the various items attached to them.

Fix the longest piece of tube first. I fastened mine by using some plastic insulation tape, followed by a tie with a short piece of 22 gauge plastic insulated wire to make each point firm. The tube will need to be offset on the cup hooks so that the matching stub tube may also be fixed in place on the lower cup hooks, with a spacing of 25mm on centres. The top five-eighth element may be fixed next.

The bottom of the matching stub must be shorted and this may be done by using a heavy gauge (about 14SWG or equivalent) of copper wire soldered across the two tubes. You will recall that we cut the two lengths of tubing a little longer than required and so the wire will be soldered at the point which gives the correct dimension, as shown in the drawing.

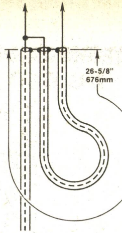
The phasing stub still has to be fitted. It may be fixed such that it sticks out at right angles to the rest of the assembly but I felt that it may be considered as a perch for some birds that may be heavier than the stub may be able to bear! Also, it makes the whole unit look a little more obtrusive. Accordingly, I bent the stub around a piece of tube about 75mm in diameter, so that the stub formed part of a circle. The stub so bent was then soldered to the two radiating elements, so that an effective length of 232mm was achieved.

With the aerial assembly completed, it now remains to fix it to a suitable support, such as a length of water pipe, fed from the feedline from the transceiver, or whatever. I made up a balun from a piece of coaxial cable as shown in the drawing and connected it to the feedline as shown. When fitting the balun to the appropriate feedpoint, it is desirable to form a gooseneck of it so that water will be prevented from entering the cable.

The aerial system should now be installed temporarily in its final position. A check should now be made to find the resonant point and the SWR at that point. I attempted to set the system to 146MHz and this is about where you may expect yours to be. If the resonant frequency is either too high or too low, the phasing stub may be shortened or lengthened as required. The point where the balun is connected to the matching stub may need to be adjusted so that the minimum possible SWR is achieved.

At the time of writing, I am feeding the prototype with fairly lightweight 75 ohm coaxial cable and the SWR at about 146MHz is about 1.2. This rises on each side and it is still acceptable at 145MHz and 147MHz but it is not possible to get a low SWR right across from 144MHz to 148MHz. This is no doubt due to the number of tuned circuits which go to make up the complete system. However, this is not unusual and a good compromise may be had by setting the resonant frequency to say 147MHz, if you are only interested in the FM portion of the band, from 146MHz to 148MHz.

If you are interested in the whole band, as I am to some extent, then short of having two aerials, the idea of using a Transmatch should not be overlooked. Although I have not done anything about a Transmatch so far, I may have a closer look at the idea in the not too distant future.



This simple balun was used to connect the coax feeder to the antenna.

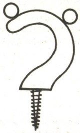


Diagram showing how the matching stub is mated with the cup hooks.

The dimensions given relating to the phasing stub and the tapping point for the feedline on the matching stub were arrived at when using some small diameter 72 ohm coaxial cable. Since then, I have run a length of RG8U 52 ohm coaxial cable. This has necessitated a change in the length of the phasing stub, as well as a change in the tapping point for the feedline. The dimension for the latter is now about 80mm, or 3-1/8in. The phasing stub dimension needed to be increased by about 20mm, or ¾in.

The prototype aerial works quite well and it appears to give the kind of results which may be reasonably expected of it. However, while I have given details as to how I made it up, I feel that there is room for mechanical improvements.

While the idea of using the nylon cup hooks for insulators is quite satisfactory, readers may have other and perhaps better methods which may be used. Also, in order to make overall adjustments of the system easier and more flexible, provision could be made to vary the lengths of the two radiating elements, together with the phasing and matching stubs. Sleeves, clamps and suitable set screws could be used to advantage. This could be a future job for me to apply to the prototype.

This article would not be complete without acknowledgement of the able assistance given by my wife during the development, construction and adjustment of the device.

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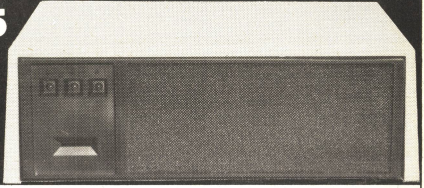

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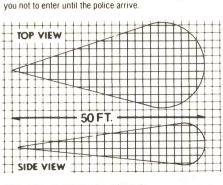

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FEATURES

Microwave transceiver

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Timing circuits permitting exit and entry

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Inputs for easy connection of external sensors such as door and window contacts, panic switches, smoke detectors.

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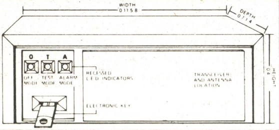
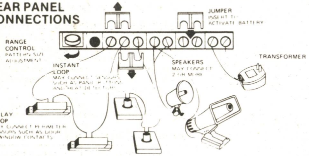


REAR PANEL CONNECTIONS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INSERT TO ACTIVATE BATTERY
RANGE CONTROL
PATTERN SIZE ADJUSTMENT
INSTANT LOOP
MAY CONNECT SENSORS SUCH AS PANIC BUTTONS AND HEAT DETECTORS
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RANGE CONTROL:	Single turn potentiometer. Range adjustment from zero to full.
SENSITIVITY:	1-2 steps within set range. Self-adjusting for constant (background) motion.
PROTECTION PATTERN:	Single lobe 50 foot maximum length, 20 foot maximum width.
EXIT TIMER:	30 seconds.
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RECHARGEABLE STANDBY: BATTERY:	4 hours standby.
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SUPPLY VOLTAGE:	12 vac/60 Hz.
ALARM CYCLE TIMER:	1 minute
SIREN ALARM: (Active during alarm cycle)	5W into 8 ohm speaker (or into any combination of speakers not resulting in less than 4 ohms)
AUXILIARY SENSOR INPUTS:	Normally closed contact.
ELECTRONIC KEY SWITCH:	OFF (Test light active for walk test purposes) ON (timers activated. Unit operational.)
TRANSMITTING FREQUENCY: (4 channels)	A 10.520 GHz B 10.523 GHz C 10.526 GHz D 10.530 GHz
SHIPPING WEIGHT:	9 pounds

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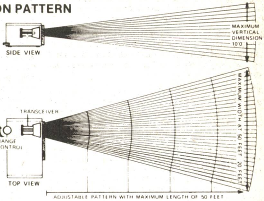
SIDE VIEW
MAXIMUM VERTICAL DIMENSION 10'0"
TRANSCEIVER
RANGE CONTROL
TOP VIEW
MAXIMUM WIDTH AT 50 FEET 20 FEET
ADJUSTABLE PATTERN WITH MAXIMUM LENGTH OF 50 FEET

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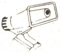

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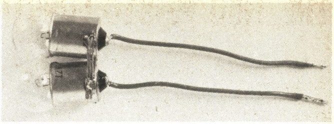
INSTRUMENT CONTEST

Using light bulbs as an RF dummy load



The two 12V 6W tail light bulbs mentioned in the text. Connected exactly as shown, they form the basis of the competition set out below.

Using a selected light bulb as a dummy load for an AM or FM transmitter is a trick well known to old-time amateurs but it may not be familiar to novice amateurs and CBers, with their predominantly commercial equipment.

by WALTER NEVILLE

If due note is to be taken of the instruction books, modern solid-state transmitters should be operated only when connected to an appropriate load, which is usually specified as 50 ohms, resistive.

Normally, this would signify an antenna designed for the particular operating frequency and so arranged that it presents a substantially resistive impedance of 50 ohms, looking into the transmitter end of the coaxial supply cable.

When it is desired to operate a transmitter for test purposes without radiating a signal, preferred practice is to use a 50-ohm dummy load. For low powered applications, this may be nothing more than a single high-wattage carbon resistor mounted in a PL-259 (or other) connector. For higher powered applications a dummy load can be constructed, using parallel resistors, along the lines mentioned on page 31 of our April 1977 issue.

However, as mentioned above, a selected light bulb may sometimes be used instead of a regular dummy load. It will certainly not be as precise but it may be near enough — and it will have the advantage of displaying the presence of RF energy by glowing more or less brightly.

In the days of valve type "home brew" transmitters, amateurs would commonly grab any likely looking low voltage bulb and couple it to the various tuned circuits by means of a simple wire loop. These days, unless you know exactly what you are about, it is wise to restrict the practice to using the right kind of bulb connected only across the antenna output socket.

A preliminary exercise in Ohm's Law will be necessary to select a bulb whose rated voltage, divided by its rated current (in amps) will yield an appropriate figure of resistance in ohms — most commonly 50 ohms. As a further requirement, the bulb wattage (volts x amps) should approximate the rated RF output of the transmitter.

As a first attempt, one might consider a dial lamp or torch bulb rated at 6V and around 0.12A. The resistance would be about right but the power rating would only be 0.72W, as compared with 4W from the usual CB AM transceiver, or 10W from the usual amateur FM mobile rig.

A more appropriate figure would be a bulb rated at about 15V and 0.3A. A further pointer to such a figure is the fact that, if one works out the voltage across a 50 ohm circuit at the 4W level, it turns out to be 14.14V.

The only problem is that bulbs rated in those precise figures would be difficult, if not impossible, to locate. On the other hand, an automotive bulb rated at 12-16V at around 0.3A (or 4W) might turn out to be quite near the mark — if you can find one.

As a simple bench exercise, one can verify the resistance of any given bulb by supplying it from a suitable DC source, measuring the current with a multimeter and resorting to the simple maths mentioned earlier. It so happens that most transceiver type bench power supplies deliver 13.8V, which could quite be handy for such a test.

Someone might be wondering why it is not possible simply to measure the resistance of a bulb with an ordinary ohmmeter. The answer is that the resistance of a filament is not constant, but varies widely with temperature. The resistance is quite low when the filament is cold but rises steeply as it begins to glow more and more brightly. To be valid, any calculation or measurement of filament resistance must take into account the voltage which is likely to be placed across it in the proposed application.

For this same reason, a light bulb is not suitable as a load for an SSB transmitter. Between syllables, when

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GRAND INSTRUMENT CONTEST No 4

Win the Trio PF-810 Power Meter reviewed alongside . . .

A dummy load was made up of two series-connected automotive tail lamps, each rated at 12V, 6W. The Trio PF-810 Function Power Meter was used to measure the VSWR when connected to the output of a normal AM CB transceiver, set to the Australian CB channel 9. Estimate, to three significant figures, the reading we obtained from our experimental set-up.

Seal an envelope, write the reading and your name and address on the back of it and send to:

PARAMETERS/E.A. GRAND INSTRUMENT CONTEST NO. 4.
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All entries must be in by Monday, September 4th, and the winner will be the first correct entry picked from the barrel.

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you could win . . .

THE TRIO PF-810 FUNCTION POWER METER

Intended primarily for use in two-way radio workshops, in colleges, and by dedicated radio amateurs, the Trio PF-810 Function Power Meter measures standing wave ratio to a figure of 10, plus power levels to 150 watts for forward, reflected, and radiated power.

In keeping with the role envisaged for it, the PF-810 is much larger than the usual SWR/Power meters favoured by CB operators, being 200mm(h) x 127mm(w) x 142mm(d), overall. The panel is predominantly black, with silver lettering and satin-chrome surround, with the main body of the case in buff lacquer.

The relatively large panel accommodates a full 110mm rectangular meter, with open-easy-to-read scales. The controls are also easy to identify and easy to use, as we discovered when we put it through its paces in a typical "Ham shack" situation.

There are three PL-259 connectors on the rear of the case, one for the associated transmitter and the other two for alternative 50-ohm antennas (or loads). A push-button on the front panel selects "Ant.1" or "Ant.2" as desired.

This is a handy facility, in that the user can readily compare readings from different antennas or with those from a 50-ohm reference load. Alternatively, the instrument can be left in circuit with the meter movement switched "Off", so that it can double as a low-loss antenna changeover switch, when not otherwise in use.

The procedure for reading SWR (standing wave ratio) is as normal: The meter is set to exact full scale for forward power, with a "Calibration" control; when the function switch is rotated to the SWR position, the ratio is read directly on scale calibrated from 1 to 10. For the reading, the power output of the transmitter must not be less than 1W, nor presumably more than 150W.

When it comes to RF power measurement, simple instruments are often difficult to read because the calibration tends to follow a square law, with the lower readings crammed together. In the PF-810, the designers have incorporated special linearising circuitry to virtually eliminate this effect. They have also provided three distinct scales: 0-5, 0-25 and 0-150 watts.

Power is measured in three modes: "FWD" as the power flowing from transmitter to load; "REF" as the power flowing from the load back towards the transmitter; "RAD" as the difference between the two. The makers claim that, in the latter mode, the instrument can facilitate checking of antenna performance, particularly if connected adjacent to the antenna. They claim that the instrument is easier to use than a conventional directional wattmeter using two meter movements.

Be that as it may, the PF-810 can double as a conventional SWR meter and a conventional power meter, as well as providing readings for forward, and reverse power and a difference reading.

Other specifications for the PF-810 give the frequency range as 1.8 to 200MHz, power measurement accuracy within 10 per cent of full scale, residual SWR as less than 1.2 and insertion loss less than 0.5dB. A 16-page booklet, packaged with the instrument, contains a circuit diagram and explains the operation and role of the instrument, albeit in slightly "fractured" English.

Price of the PF-810 at the time of writing was quoted as $159.85. It was supplied for review by Parameters Pty Ltd, 68A Alexander St, Crows Nest, NSW 2065. Tel. (02) 439 3288. (W.N.W.)

Light bulbs as dummy load — cont.

the RF output drops to near zero, the transmitter is looking into a very low resistance, which pulses to a much higher value on voice peaks. With an AM or FM transmitter, on the other hand, the RF output is sustained at all times and the filament assumes an appropriate mean temperature.

Which brings us to the two bulbs shown in the picture. In searching around for something suitable, we were offered two auto tail light globes in a plastic pack. Each was rated at 12V 6W. A spot of mental arithmetic suggested that each bulb would draw 0.5A and represent a resistance of 24 ohms at the rated voltage. As a load, a single globe would therefore be well below the target figure of 50 ohms.

What about using the two in series? Across about 14 volts, or 7 volts each, they would be under-run and presumably exhibit a resistance of less than 24 ohms each. But then, how accurate are the ratings of auto tail lamps?

Without knowing quite what to expect, we connected the two bases together and attached flying leads to the two tips. We then connected the series combination across a 14V DC supply, measured the current and worked out the resistance. It came close enough to 50 ohms to hold promise as a load for a CB transceiver. It would not be spot-on 50 ohms and therefore not suitable as the basis for a precise power measurement, but it would glow brightly enough to show RF output and the effects of modulation.

This done, we attached the bulbs to a PL-259 connector and coupled it to the "Antenna" socket of the Trio PF-810 SWR/power meter which was, in turn, coupled to a normal CB AM transceiver set to Australian channel 9. With this set-up, we were able to measure the standing wave ratio (or SWR), which could be expected to reflect any discrepancy in the DC resistance of the filaments, plus the effect of any inductance in the two filaments.

What was the final SWR figure? We're not saying, because that forms the basis of the accompanying competition.

Winner of contest No. 2

The winner of the Parameters/EA Grand Instrument Contest No. 2 is:

Mr T. Hasarliev,
4 Winnunga Place,
Armadale, WA 6112.

Mr Hasarliev correctly nominated the resonant frequency of the tuned circuit at 4.10MHz, and his was the first correct entry picked from the barrel. He wins the Trio DM-800 Dip Meter, donated by Parameters Pty Ltd.

Our congratulations to Mr Hasarliev, and our thanks to the several hundred other readers who participated.

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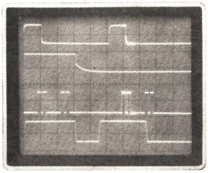
In addition the PM 3212 offers automatic TV triggering: the PM 3214 a fully calibrated delay and full sweep facilities. And by full we mean: independent main and delayed timebase triggering, separate source triggering for both channels and both timebases, including DC, plus the alternate timebase mode.

For an encore, both instruments offer a battery option, versatile X-Y display facilities and a double-insulated power supply, which eliminates the need for an earth connection and with it the associated problems of earth loops and hum.



New price/performance standards are set by the PM 3214, as demonstrated by the alternate timebase mode. This allows both the main and delayed timebase signals to be displayed at the same time, for both channels.

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Circuit & Design Ideas

Conducted by Ian Pogson

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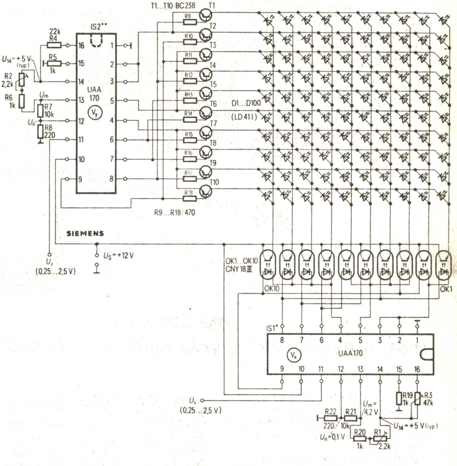
LED display with UAA170 ICs for simple patterns and Lissajous figures

The rapidly increasing production of LEDs has made these components available at economical prices and applications which require a large number of LEDs are thus becoming a practical proposition.

The UAA170 is an IC which can control a LED line. When a certain voltage is applied to input pin 11, one LED is illuminated giving a light on the line. By using two UAA170s, a two-dimensional LED matric can be controlled. One IC (Vx) serves to drive the rows and another IC (Vy) is used to drive the columns.

A simple circuit may be used to control a matrix composed of 4 x 4 LEDs. For many applications, however, the resolution obtained by a matrix of only 16 LEDs will not be sufficient. The control of LED matrices with more than four lines and columns can easily be realised by adding a few more components. One solution is to insert optocouplers to control the rows and columns. To limit component costs, optocouplers are only used for driving the LEDs on the horizontal lines of a 10 x 10 matrix as shown in the diagram. The vertical lines are driven by NPN transistors.

The voltage divider values for the reference voltages Um and Un of Vx and Vy are calculated such as to produce a voltage range of 0.25V to 2.5V on the rows and columns of the matrix, respectively.



Naturally, LED matrices of other sizes than those indicated can be driven, for example, 4 x 16 LEDs, or 16 x 16 LEDs. For more than 16 LEDs on the x or y line, as for instance 4 x 31, or 31 x 31 LEDs, two UAA170 ICs are series connected to build up Vx or Vy.

(By Rolf Gerken, in "Siemens Components Report".)

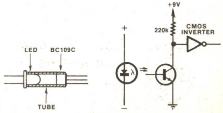
Isolation obtained with an opto-coupler

In interfacing my computer to a motional control cassette deck I had to be able to control five 50V solenoids. Opto isolation is possibly the best method to isolate TTL levels from "spikey" high voltage mechanics, but commercial opto-couplers are expensive. I therefore built my own.

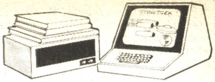
The light emitter is a large red LED glued in one end of a 12mm length of a ballpoint pen tube. In the other end is glued a BC109C silicon transistor with its cap cut off. To do this, first get a metal can BC109C and use a wire stripper (one that consists of two flat metal arms riveted together) and crimp around the top of the can. Because of the V-shaped cutting edge on the tool the can will be pinched and cut. Make many cuts around the top so as not to close off the transistor.

Cover the tube of the completed unit with black tape so as to prevent ambient light from affecting operation. With 20mA flowing in the LED the transistor on resistance is 100k and the off resistance is 1M. A CMOS hex inverter is used to buffer the output. The transistor collector pullup resistor may have to be varied to suit the particular conditions, such as variations in transistor characteristics, LED light output, etc.

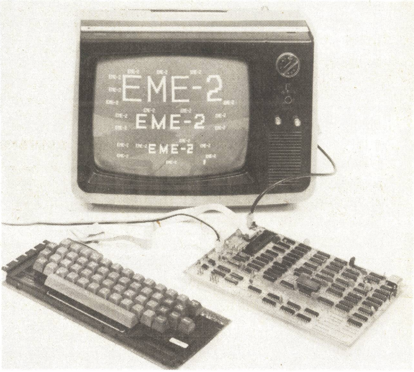
By Mr Alan Peek, 10 Gale Street, Woolwich, NSW 2110.)



Microcomputer News & Products



New video module from E&M



E&M Electronics has announced a new video display module for microcomputers, the EME-2. The new module is based on the very successful model EME-1, as used in the EA Video Data Terminal of January and February 1977, but now includes on-board cursor circuitry, a unique graphics facility and interfacing for 20mA loop, RS232-C and TTL communication.

The EME-2 is a dual mode, single board unit capable of displaying alphanumeric and graphics information simultaneously. It forms a complete terminal simply by the addition of a display such as a TV receiver or video monitor, an encoded ASCII keyboard and a DC power supply.

The alphanumeric display format is 16 lines of 64 characters, while the graphics format is 128 horizontal by 48 vertical points. The EME-2 can display the full 64-character 6-bit ASCII subset in alpha-numeric mode, while in graphics mode it can display any one of 64 symbols based on a 3 x 2 matrix.

Other features include automatic clear and home on switch-on and in response to the form feed character (FF), with home position being at the top left-hand corner of the screen; automatic return and line feed after the 64th character of a line; choice of flashing, steady or disabled cursor; two variable controls for display centering; selectable communication rates from 110 to 9600 baud (all crystal controlled); and both video and modulated RF output.

Like its predecessor the EME-2 comes as either an assemble-it-yourself kit or a fully assembled and tested module. With it comes a Users Manual, with full details of kit assembly and checkout. The manual also gives suggestions for further optional expansion.

Price of the EME-2 kit is expected to be around $232 plus tax, which seems very good value for money. The assembled module will be around $295 plus tax, which is again very reasonable.

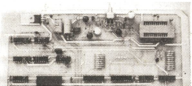
Incidentally the EME-1 module is still available, and its price has been lowered to $169 plus tax for the kit or $249 plus tax for the assembled module.

For further information on either the EME-2 or EME-1 video modules, contact E&M Electronics at 136 Marrickville Road, Marrickville, NSW 2204 or telephone (02) 51 5880.

Hex/octal calculator

A new calculator from Texas Instruments has been designed specifically for machine and assembly language computer programming applications. It can perform calculations in decimal, hexadecimal and octal notations, as well as conversions between these notations.

Either one's or two's complement arithmetic may be used in octal and hex modes, and bit-by-bit logical operations may be performed in these modes also.



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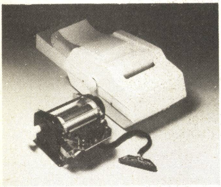
Other features include 15 sets of parentheses at each of four processing levels, independent memory, constant mode and automatic battery saver facility.

Further information on the TI Programmer Calculator is available from AJF Systems & Components Pty Ltd, 44 Prospect Road, Prospect, South Australia 5082.

40-column printer



A drum-type line printer with a 48 or 64 character set and 40-column width is now available from MACE. Made in Japan, the Kyodo model Ro-101P printer prints at approximately one line per second including paper feed, and is intended for use with mini and micro computers. The impact printing method allows up to four carbon copies to be printed on 152mm-wide fan fold computer-type paper. A number of character sets are available.

The unit comes complete with power supply and a TMS9980 microcomputer interface controller. This permits the printer to interface with 8-bit parallel ASCII, RS232, 20mA current loop TTY or IEEE 488'9 ports at speeds up to 9600 baud.

The printing mechanisms are also available separately for OEM applications. The mechanism is of industrial quality and employs a hardened steel print drum and a standard typewriter ribbon.

Further information is available from Measuring and Control Equipment Co Pty Ltd, PO Box 78, Epping NSW 2121.

PACE, SC/MP courses

NS Electronics is currently holding a series of applications and programming courses on their PACE/8900 and SC/MP microprocessors. The courses are held each Tuesday for a five-week period, to make it easier for people who cannot take a full week off to attend a course.

In Sydney a course will be held from September 5 to October 3 at the NS office in Brookvale. This course covers both the PACE/8900 and SC/MP.

In Melbourne a course will be held from October 31 to November 28, at the NS facility in Bayswater. This course will be directed specifically to the SC/MP. Emphasis will be on industrial

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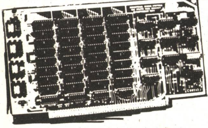

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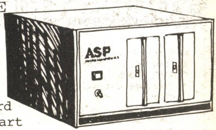

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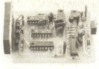

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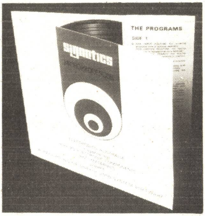
The EA-Philips 2650 System Software Record is available from the Electronics Australia office for $2.50, or $3.00 posted anywhere in Australia from EA, P.O. Box 163, Beaconsfield, NSW 2014.



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HEF 4007UB	.30	HEF 4019	.73	HEF 4035	1.28	HEF 4066	.80	HEF 4081	.30	HEF 4520	1.41
HEF 4008	1.24	HEF 4020	1.41	HEF 4040	1.37	HEF 4068	.33	HEF 4082	.32	HEF 4528	1.02
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HEF 4012	.30	HEF 4022	1.22	HEF 4042	1.96	HEF 4070	.32	HEF 4086	.94	HEF 4539	1.12
HEF 4013	.50	HEF 4023	.30	HEF 4043	1.24	HEF 4071	.30	HEF 4093	.96	HEF 4555	1.02
HEF 4014	1.28	HEF 4024	.99	HEF 4044	1.24	HEF 4072	.32	HEF 4510	1.34	HEF 4556	1.02
		HEF 4025	.30	HEF 4046AE	2.92	HEF 4073	.32	HEF 4511	1.76		

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7812	12V	1A	1.30	7912	—12V	1A	1.75
7815	15V	1A	1.45	7915	—15V	1A	1.75
7818	18V	1A	1.45	7918	—18V	1A	1.75
7824	24V	1A	1.45	7924	—24V	1A	1.75

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For further information and engolments contact Ed Schoell in Melbourne (03) 729-6333 or Chris Mason in Sydney (02) 93-0481.

Brisbane club

We have been advised that there is a Microcomputer Interest Group in Brisbane, having been organised in June 1977 and now very healthy with some 150 members. It was recently incorporated as an interest group within the IREE.

Meetings are held on the second Friday of each month at 7.30 pm at the Windsor State School, Harris Street, Windsor. Apart from these meetings the Group has also arranged 10-week tuitional courses with the Technical and

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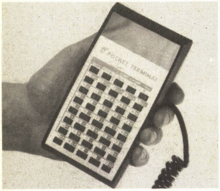
Further Education Department. There are four tuitional groups, two at beginner level, one at advanced level and one on programming.

Further information on the group and its activities is available from the secretary, Mr Normal Wilson, Microcomputer Interest Group, PO Box 81, Albion Queensland 4010, or telephone 356 6176.

Hand-held terminal



A new hand-held ASCII data terminal for microprocessor programming, production data entry, warehousing, mobile data collection, training and education is available from the Dindima Group. Known as the GR Electronics Pocket Terminal, it is capable of both sending and receiving asynchronous serial data in ASCII code.

It has a 40-key keyboard with positive tactile response, allowing transmission of all 128 ASCII character codes, and a repeat facility utilising the maximum data rate. The display uses eight 16-segment "starburst" LEDs which can generate all upper-case alphanumerics in the 6-bit ASCII subset. An internal memory allows the last 30 characters received to be accessed in blocks of eight characters.

Two versions of the terminal are available: one with 20mA current loop inter-facing and the other with V24/RS232 levels. Both versions include a "bleeper" which provides an audible response on reception of the "BEL" character.

For further details contact The Dindima Group Pty Ltd, PO Box 113, Balwyn, Victoria 3103.

Data concentrator

A new data concentrator/multiplexer especially designed for inquiry-response systems has been announced by Kaufman Research. Designated the model 811, the unit allows up to eight high speed (up to 19,200 baud) lines to be connected to a single computer port. Buffer storage of several hundred characters per line makes it feasible for a small computer system to support many devices without fear of losing data.

For further information write to Kaufman Research at 99 Sylvan Way, Los Altos, California, USA 94022.

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Ultra-low cost VDU is software driven

This is the first of two articles dealing with the construction and use of an ultra-low cost video display for microprocessors using the software-driven direct memory access (DMA) technique. Here the author describes the design and construction of the VDU, while the second article will present some program subroutines for its use.

by DAVID L. CRAIG 134 Victor Street, Holland Park, Queensland

Over the past year or so several articles have appeared in electronics magazines describing video display units for use with microprocessor systems. EA has already published two designs for VDUs, one in January 1977 using 61 ICs and costing $200 and the other in February 1978 using 45 ICs and costing around $100. Most of the designs published so far have used dedicated memory, and have used hardware cursor and memory update circuitry to perform all the housekeeping functions to control the VDU. However, this is not really necessary if the VDU is only to be used with a microprocessor system and not as a self-contained unit.

Where the VDU is to be permanently associated with a microprocessor system, a much simpler and cheaper device can be produced using the direct memory access (DMA) technique. Separate memory for the VDU is not required since the VDU circuit interrogates part of the microprocessor memory every time the display has to be refreshed. To ensure that there are no clashes between the CPU and the VDU in addressing the shared memory, the CPU is halted while the VDU accesses the memory to refresh the display. The cursor and memory update circuitry may also be eliminated because the CPU has control of the memory, and can provide whatever updating and cursor facilities are required under program control. A simplified block diagram of the system is shown in Fig 1.

Having control of memory updating and the cursor in the hands of the CPU has several important advantages. In a conventional VDU, updating of memory contents is normally only able to be done at the rate of one character per TV frame. To completely change the contents of a 512 character display takes over 10 seconds. With the CPU doing the memory updating, the complete screen memory can be changed every frame if desired, and any screen character can be altered at random without waiting for the cursor to point to it. This opens up possibilities for display motion and video games not available with conventional VDUs. Control characters (eg, line feed, carriage return, backspace) and special functions (eg, scrolling, cursor) are easily provided by having a subroutine perform the appropriate actions on the relevant memory locations.

As with everything else in this world, nothing is free. There is a price for the advantages of reduced circuit complexity and cost, and the increase in flexibility. This is a reduction of CPU throughput, resulting from the CPU being halted every TV frame to allow the VDU to refresh the display. In the VDU described in this article the CPU compute time is reduced to 50%. In most cases this is unimportant. When using a VDU in an interactive situation the CPU will spend most of its time idle anyway, waiting for the next input, so that available computing time is not really significant. If full computing time is required, a facility is provided to disable the display by preventing the CPU from being halted.

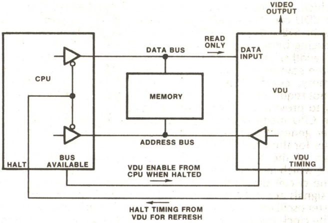

FIG. 1 : SIMPLIFIED BLOCK DIAGRAM OF DMA VDU SYSTEM

When operating with the VDU enabled, care should be taken in using software timer loops in which a number of clock cycles are counted to get a specified delay time. Because the VDU can halt the CPU in the middle of such a loop, the delay times can be erratic, even though the number of counted clock cycles remains constant.

The VDU circuit described in this article uses the DMA technique. It uses only 15 ICs and should cost around $25-$30 to build. While the circuit was designed for use with a Motorola 6800 microprocessor, it can be used with any CPU whose address and data bus lines can be floated by an external halt command. Total current consumption is about 350mA using standard TTL devices.

The VDU circuit is based on the same dot matrix character generator IC, the 2513, used in the other articles referred to earlier. The version recommended is the General Instruments RO-3-2513 which requires only a single +5V power supply. Other versions requiring +5V, —5V and —12V supplies can be used, if the additional voltages can be provided. The 2513 provides a 5x7 dot matrix representation of a 64 character alphabet consisting of upper case letters, digits and a number of special characters. To display a character, the six bit ASCII code for the character is applied to the inputs of the 2513 together with a three bit address to indicate the line of the matrix to be displayed. The 2513 gives a five bit parallel

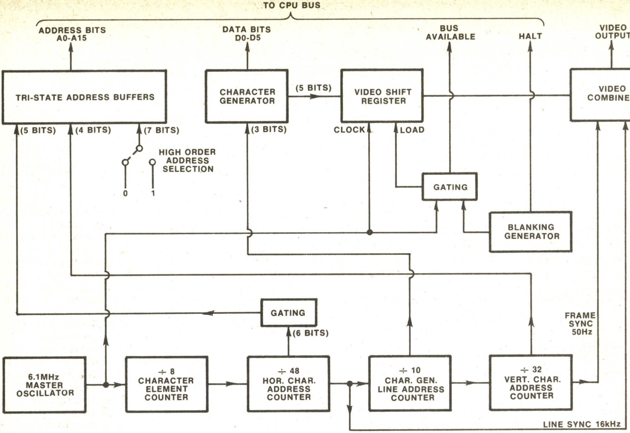

FIG. 2 : VDU CIRCUIT BLOCK DIAGRAM

output which must be serialized to provide the required video output.

The display format used for the VDU is 16 rows of 32 characters each, giving a total display of 512 characters. For a 6800 CPU which can address 64K of memory, the VDU can display any one of 128 pages of 512 words each. The horizontal spacing between characters is three dot widths, and the vertical spacing is three scan lines.

Since memory, cursor and update circuitry are not required, the VDU circuit has only to provide timing signals to access the CPU memory, drive the 2513 character generator and produce the sync pulses for the video display. A block diagram of the VDU circuit is shown in Fig 2, which may also be compared with the circuit diagram.

All timing signals are derived from a single LC master oscillator (Q1) running at 6.1MHz. The clock frequency is then divided down by a chain of frequency dividers (ICI-5) to provide the rest of the timing signals. This ensures that all the timing signals are locked together, and that only a single frequency adjustment is necessary. It will be noted from Fig 2 that the line frequency derived is 16,000Hz rather than the normal 15,625Hz. This gives 320 lines per scan instead of the usual 312.5, but does not affect the horizontal locking of the display. On the other hand, the frame frequency must be exactly 50Hz for a stable display.

Each scan line is divided into 48 character spaces, only the middle 32 of which are used to display data. Some decoding of the divider output is necessary to obtain the correct horizontal character address at the right position in the scan. This is provided by the exclusive OR gates IC11a-b. A similar situation exists for the character generator line address where the 2513 uses only eight of the 10 line addresses generated, and for the vertical character address where only 16 of the 32 generated addresses are used. For both these cases the decoding simply requires ignoring one bit. Whenever unused addresses are generated, blanking signals are produced by IC11c-d, IC9c-d and IC10a.

The horizontal and vertical character addresses provide address bits A0—A8 for accessing memory. The higher order address bits A9—A15, which define the particular 512-word page of the CPU memory to be displayed are provided by strapping high (1) or low (0) as required. Alternatively, a DIP switch can be used if easier page selection changes are required, or the address selection can be placed under program control by connection to the outputs of a PIA or similar device. All the memory address bits A0—A15 are interfaced to the CPU memory bus using tri-state buffers (IC13-15), which are activated only when the CPU is halted. This ensures only one set of address bus drivers is active at any one time, so there is no conflict between the CPU and the VDU.

The CPU is halted to allow display refresh during the 16 active character rows by using the blanking signal from the vertical character address circuit to generate, via IC10d, the NHALT (active-low HALT) signal required by the 6800 CPU. A display disable switch (S1) is provided which prevents the CPU being halted. The display is blanked when S1 is operated. S1 can be replaced by a connection to a PIA output to put the display disabling under program control, if required.

After receiving the NHALT signal the 6800 halts on completion of either the current or the next instruction being executed. On halting, the 6800 puts all its bus senders and the R/W (read/write) line into the high impedance tri-state mode, sets VMA (valid memory address) low and BA (bus available) high. The BA signal going high is used to activate the VDU memory address drivers and also produce VMA (VDU) and R/W signals needed to access the CPU memory. Since the VMA signals are not tri-state, a modification is needed on the CPU board to OR together the VMA signals produced by the CPU and VDU. This is shown in Fig 3.

When the VDU addresses the CPU memory, the six least significant data bits D0—D5 are returned to the character generator inputs. Note that only six of the eight bits stored in the CPU memory are used by the VDU. The five bit parallel output from the character generator (IC6) is fed to an eight bit parallel in/serial out shift

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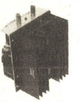

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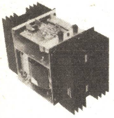

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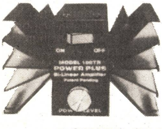

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register (IC7) for conversion to serial output. The data output from the character generator is not valid most of the time because of the delay times in getting valid data out of the CPU memory and the character generator ROM. To provide sufficient time for the data to settle, the shift register is loaded, using IC12, just before the memory address changes to the next character. The CPU memory access time should be less than 750ns to ensure correct operation.

Screen blanking during inactive periods of the display is achieved by inhibiting the loading of the shift register using blanking signals applied to IC12. Because the serial input of the shift register is grounded, once all valid data is clocked out zeros are then shifted out giving a blank display till the next load signal arrives.

The serial output of the shift register has only to be combined with sync pulses to give the required video output. The horizontal sync pulse used is about 2us wide, and a single 400us pulse is used for the vertical sync pulse. Even with such a simple sync pulse structure there is no difficulty in getting the picture to lock. The sync pulses are generated by differentiating the negative-going edges of the most significant bits of the horizontal and vertical character address signals.

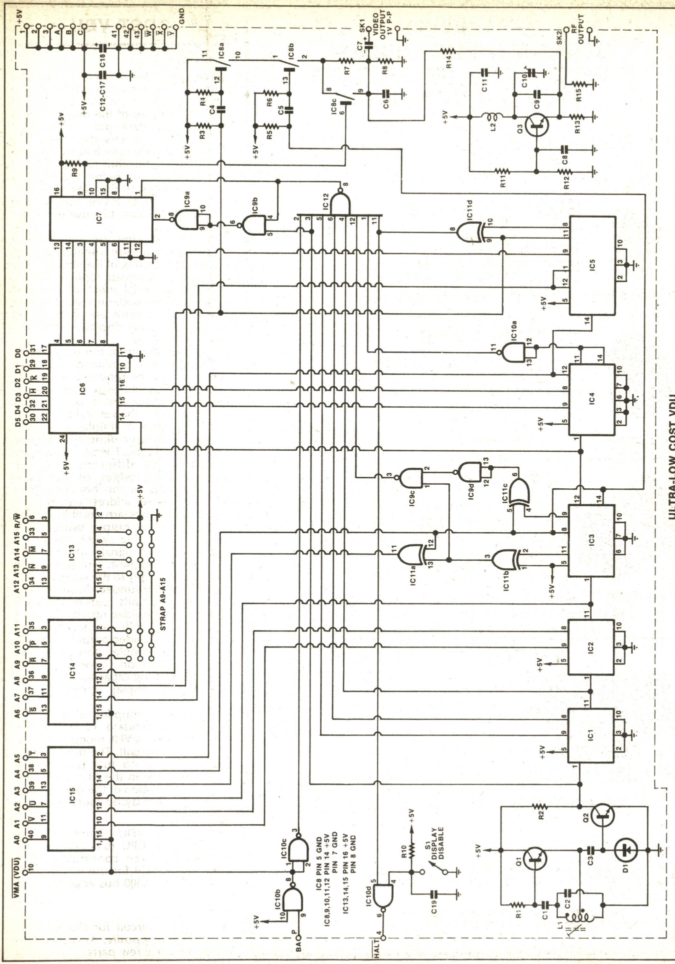
The sync pulses are combined with the shift register output using IC8, a CMOS 4066 analog switch, to give a standard 1V P—P signal with an output impedance of 75ohms. Sync pulses turn off the +5V supply to the video output, which is then grounded through R8. A zero from the shift register turns off IC8c making the video output 330mV. A one from the shift register turns on IC8c giving a 1V video output level. The output is AC coupled through C7 to provide DC isolation. Capacitor C6 is an optional smearing capacitor which may improve the display appearance in some cases.

To allow the coupling of the video signal into a standard TV set via the aerial terminals, a VHF modulator is included in the circuit. The modulator is almost identical to that used in the video ball game in the May 1976 issue of EA. A description of the operation of the modulator may be found there.

Construction

Because the VDU circuit connects directly to the CPU data and address buses, it has been constructed on a double-sided PCB for use with a standard Motorola 6800 bus edge connec-

The complete circuit for the low-cost VDU is shown opposite. As you can see it uses relatively few parts.



ULTRA-LOW COST VDU

IC8 PIN 5 GND
IC8,9,10,11,12 PIN 14 +5V
PIN 7 GND
IC13,14,15 PIN 16 +5V
PIN 8 GND

tor. The PCB is 9.8 inches by 5 inches with a 2x43 way edge connection. All the signals at the edge connection are standard, both in pin number and signal level, for the Motorola 6800 bus, so that the VDU board can be plugged into any 6800 bus connector. The only signal not found in the standard 6800 bus is the VMA (VDU)-bar signal which has been assigned to pin 10 of the edge connector; this pin is not normally used in the Motorola bus.

The master oscillator coil (L1) is wound on a Neosid 722/1B coil former with a Neosid 4x0.05 x 6/f29 slug. Two separate windings of 25 turns each of 0.315mm enamelled wire are wound one on top of the other in the same direction. The top end of the bottom winding is joined to the bottom end of the top winding for the centre tap.

The modulator coil is made from a number of turns of 22 B&S enamelled wire wound with a diameter of 3mm. Ten turns allows the modulator to be tuned to channel 1 or 2, while five turns enables tuning over channels three to nine. The modulator should only be tuned to a vacant TV channel, and when used with a TV receiver the antenna should be disconnected to prevent interference.

All components except the 2513 character generator IC can now be mounted on the PCB. Begin with the passive components, followed by the TTL ICs, and install the CMOS 4066 last observing the usual precautions in handling CMOS. Unless a plated-through PCB is used, a number of wire feed-through connections are required, and a number of component leads must be soldered on top as well as beneath the PCB. The A9 —A15 address strapping should also be done at this stage. Temporary feed-throughs at IC6 pins 10 and 24 are also required.

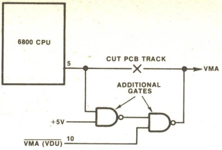


FIG. 3 : CPU BOARD VMA SIGNAL MODIFICATION

A tinplate shield is required over the modulator components to prevent spurious radiation and pickup. This should be 2.6 inches square and 0.5 inches high with holes appropriately placed to allow access to the trimmer capacitor C10 and to allow R14 and the RF output lead to pass through. The shield is spot soldered to the earth ring on the PCB surrounding the modulator components.

At this point the VDU board can be powered up. It should not be connected to the microprocessor, but only to the TV display, preferably by the direct video output into the video amplifier stage of a suitably modified TV set. Video information should appear on the display but there will probably be tearing of the picture. The frequency of the master oscillator is adjusted using the slug in L1 to obtain picture lock with no horizontal wavering. This ensures a frame rate of 50Hz, which minimizes the effect of power line interference.

PARTS LIST FOR THE LOW-COST VDU

INTEGRATED CIRCUITS

IC1	*7493*	*IC6*	*RO.3.2513*	*IC11*	*7486*
IC2	*7493*	*IC7*	*74165*	*IC12*	*7430*
IC3	*7492*	*IC8*	*4066*	*IC13*	*74367*
IC4	*7490*	*IC9*	*7400*	*IC14*	*74367*
IC5	*7493*	*IC10*	*7400*	*IC15*	*74367*

Note: Either standard 7400 series TTL or low-power Schottky 74LS00 series TTL may be used.

RESISTORS (all ¼ watt)

R1	*470K*	*R6*	*33k*	*R11*	*1.5k*
R2	*1k*	*R7*	*1k*	*R12*	*1k*
R3	*2.2k*	*R8*	*82*	*R13*	*1k*
R4	*33k*	*R9*	*2.2k*	*R14*	*1.5k*
R5	*2.2k*	*R10*	*10k*	*R15*	*82*

CAPACITORS

C1	*10pF*	*C6*	*470pF*	*C11*	*0.001uF*
C2	*47pF*	*C7*	*47uF 25V electro*	*C12-C17*	*0.01uF*
C3	*10pF*	*C8*	*330pF*	*C18*	*10uF 6V electro*
C4	*0.01uF*	*C9*	*10pF*	*C19*	*0.047uF*
C5	*68pF*	*C10*	*10-40pF trimmer*		

MISCELLANEOUS

Q1	*BC108*	*Q2*	*2N3643*	*Q3*	*BF173*
D1	*1N914*				

S1 Single pole switch
L1 Coil former Neosid 722/1B, Slug 4x0.05x6/f29, 2 layers of 25 turns of 0.315mm enamelled wire
L2 5 or 10 turns of 3mm diameter of 22 B&S enamelled wire.
SK1-SK2 75ohm coaxial sockets (mount as required)

The display should show a chequerboard pattern of 16 rows of 32 white squares separated by black lines. Since the character generator IC is not inserted, the inputs to the TTL shift register float high causing all active elements on the screen to be white. The chequerboard pattern will be centered vertically, but will probably be slightly left of centre horizontally. The horizontal position can be shifted slightly with the horizontal hold control, but because of the timing of the line sync pulse it will normally be slightly left of centre.

Once the video output signal of the VDU circuit has been proved, operation of the modulator can be tested by connecting the RF output to the aerial terminals. The TV set is tuned to the required unused channel, and the modulator trimmer capacitor (C10) adjusted until the chequerboard pattern is obtained with maximum clarity.

The modification to the CPU board should now be done to OR together the VMA (CPU) and VMA (VDU) signals. The modification made will depend on the CPU board in use, but it is suggested that the VMA track on the CPU board is broken close the CPU and routed through an inverter. The resulting signal is then NANDed with the VMA (VDU) bar signal from pin 10 of the VDU edge connector, and the output fed to the CPU board VMA line.

The 2513 character generator IC can now be inserted, observing the precautions for handling MOS devices, and the VDU board connected to the microprocessor bus. When the system is powered up, a random pattern of characters should appear on the display. Check that the display disable switch blanks the screen, and check that changing the contents of memory locations within the 512 word page accessed by the display causes a change in the displayed character, eg, hex. "20" should give a blank, hex "01" an A, and hex "30" a zero.

The VDU circuit is then fully operational, and its scope for displaying information is only limited by the user's imagination and ability to write software to control the display. In the second of these articles some useful subroutines for use with this VDU will be presented to demonstrate its flexibility.

Editor's Note: Due to space limitations in this issue, the PCB pattern and wiring diagram for the VDU project have been held over until next month.

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8-bit Digital input output.
Journal printer interface.
8-bit 2-channel AD converter and joystick.
Speaker: 2octave output speaker.
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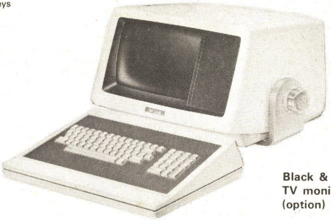
Optional Units:

- Power supply: input 230V 50Hz, output 5V. 4A and 12V, 0.5A for M100 CPU.
- Colour graphic (256 x 192 dots) display controller.
- black & White TV monitor (24 lines of 64 characters).
- Colour TV monitor.
- S100 Bus extension cabinet.
- 8 outlet power control box.



Black & White TV monitor (option)

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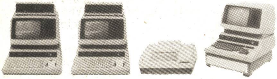

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- M230 Laboratory Model and printer
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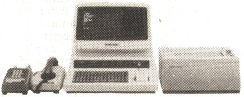

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NEW BOOKS FROM NEWNES — BUTTERWORTHS for the RADIO ENTHUSIAST

NEWNES TAPE RECORDER SERVICING MANUAL 2nd Edition – Volume 1 & 2 – Gardner

NEWNES TAPE RECORDER SERVICING MANUAL volumes 1 and 2, provide the service engineer with information on a wide range of reel-to-reel and cassette machines produced between 1968 and 1974, following broadly the lines established in Tape Recorder Servicing Manual by H. W. Hellyer covering machines produced before 1965. Volume 1 covers models produced in the period 1968 to 1970 while Volume 2 covers 1971 to 1974 models.

The information given is as concise as possible consistent with providing the engineer with the most important tests and adjustments and assumes that the engineer has a basic knowledge of test procedures. In the case of some of the older models these volumes may well represent the only source of information, covering over 100 individual models. Each entry includes at least a circuit diagram, supplemented in most cases by the more important electrical and mechanical adjustments, and a brief resume of the manufacturer's original specification. Most entries also include details of printed circuit layouts.

RADIO, TELEVISION AND AUDIO TECHNICAL REFERENCE BOOK – Amos

To reflect the changes in hardware and maintenance practices, it was decided to publish this new reference book to serve firstly the needs of the technician who has to operate and maintain electronic equipment, and secondly, those of the engineer and designer.

In consequence, the book is a comprehensive and definitive source of information that will be invaluable to the technical assistant, the technical operator, the service man and the amateur radio or audio enthusiast. Mathematical presentation has been kept to a minimum and the book gives an essentially practical account of modern developments in radio, audio and television.

MASTER CREATIVE TAPE RECORDING – Gardner

In this book the theory of recording and reproduction is covered, as well as the choice of your machine and microphone, improvising a studio, and setting up of equipment. Guidance is given on the general organisation of recording sessions, and on the problems of recording drama, features and music, and of tape editing.

BEGINNER'S GUIDE TO INTEGRATED CIRCUITS – Sinclair

INTEGRATED CIRCUITS are more complex and versatile than equivalent circuits using discrete componants. Yet at the same time they are smaller, cheaper and more reliable. There is now hardly any item of domestic electronic equipment not incorporating at least one integrated circuit.

This book is for the comparative newcomer to electronics, with some knowledge of transistor circuits, wishing to move on to an understanding of integrated circuits. Ian Sinclair first describes their principles and construction, then moves on to their many different uses. Many examples are given of practical integrated circuits. Both linear and digital integrated circuits are covered, and there is a brief introduction to digital circuit techniques for the beginner unfamiliar with this type of circuit. The operation and uses of several specialised types of integrated circuits are also described. The book is copiously illustrated.

BEGINNER'S GUIDE TO RADIO – King

This new edition of BEGINNER'S GUIDE TO RADIO continues the work of its predecessors, which have given many thousands of readers a sound basic knowledge of radio principles and practice. Gordon King has again completely rewritten the text in order to keep up to date with radio technology while reorganising and improving the description of fundamental principles.

The book takes you in logical steps from the theory of electricity and magnetism to the sound you hear from the loudspeaker. It describes the nature of the radio signal, what is involved in transmitting and receiving it (including stereo broadcasting), and what kinds of equipment are needed. Then it examines the components of a receiver, and how they are built up into circuits that will do the various jobs required. Finally, it outlines the improvements that are incorporated in modern (especially hi-fi) receivers and loudspeakers.

Written in a non-technical, highly readable style, with a minimum of mathematics this guide provides the newcomer to radio with an enjoyable introduction to the subject: it will open the door to further reading and to greater skill in handling radio equipment, whether for work or leisure.

RADIO CIRCUITS EXPLAINED – King

Circuits used in modern radio receivers are examined in detail ranging from the simple transistor radio to the specialised hi-fi receiver. The book will provide a clear understanding of principles and operation and design parameters of contemporary sets. Invaluable to radio and audio service technicians, to the student and to anyone interested in radio.

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A completely rewritten edition containing a practical introduction to five specific integrated circuits. The projects range from simple low-level amplifiers to precision measuring and indicating instruments, and include a host of unusual gadgets. All integrated circuits are internationally available and all circuits have been fully evaluated by the author. The book should be of equal interest to the amateur, the student and the professional engineer.

OP-AMPS – THEIR PRINCIPLES AND APPLICATIONS – Dance

This book is intended for home constructors and other electronics enthusiasts who require information on operational amplifiers in order to use them in conventional circuits. The text is written in an easily readable and non-mathematical style and is profusely illustrated with helpful circuit diagrams. A useful glossary of terms is included.

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Classical Recordings

Reviewed by Julian Russell

Beethoven — Concerto No. 5: very highly recommended

BEETHOVEN — Concerto No. 5 for Piano and Orchestra (The Emperor) in E Flat. Alfred Brendel (piano) with the London Philharmonic Orchestra conducted by Bernard Haitink. Philips Stereo Cassette 7300 542. Also available on disc.

When Philips first released their novel Musicassette and cassette player on the Australian market some years ago I wrote — in the first article on the subject to appear in a metropolitan daily paper, The Sydney Sun, — that though the process had its deficiencies when compared to a good disc, improvements were inevitable, and that I should not be surprised that because of its many conveniences and compactness it would, in time, challenge the older form of disc recording.

The player Philips provided me with worked off five ordinary dry cell torch batteries, played for about an hour and the tiny tapes were plagued by a great deal of background hiss and other handicaps. Then came mains-driven players, the Dolby system (which did away with background nuisances) and, finally, improved material used for the tapes. My prophecy might have seemed a bit exaggerated at the time but at last I can write that it has come true. In my opinion this new Brendel recording (cassette) of the Emperor is indistinguishable in quality, if played on good equipment, from a first class disc made from the same master.

Indeed if you were to hide your equipment behind a screen — the speakers excepted, of course — you would be pretty safe to challenge the average listener to identify which was the cassette and which the disc. The piano tone is absolutely faithful, the orchestral part has superb quality in its warmth and wealth of audible detail, the balance between piano and orchestra is always impeccable and the dynamic range is wide enough to please the most critical. The string tone is brilliant but never wiry.

When all the advantages of such a cassette are considered — compactness, easy storage, the unlikelyhood of damage such as scratching a disc during playing — it must now be considered a strong challenger to the disc. If you think I am overstating my argument I suggest you listen to this new product.

As to the music itself, despite Brendel's many great competitors I doubt if you will find a better performance than that recorded here. You may come across a very rare passage that you might prefer under other hands, but taking it all round I personally could not wish to hear better. If you are pushed for time just listen to the slow movement with its most moving atmosphere of serenity as a sample, and I doubt if there will be many who disagree with me.

I am aware that there is at present another attempt being made to persuade buyers to invest in quadraphonic recordings on the grounds that they put the listener "right in the middle of the music". This, I think, is a fallacious argument for most traditional classical music. Moreover, in these days of smallish rooms, the placing of four speakers adds still another problem. I might add that the new cassettes are so far in stereo only and in a well designed music room I, for one, ask for nothing better. From my enthusiasm you might properly gather that I recommend this cassette with the greatest enthusiasm. And the disc is equally good.

☆ ☆ ☆

BEETHOVEN — String Quartets Op. 18, No. 2 in G; and No. 4 in C Minor. Quartetto Italiano. Philips Stereo Cassette 7300 471. Also issued on disc.

The coupling of these two quartets is unusual, and I cannot trace a similar combination on any previous recording. That in itself would constitute a recommendation. But in addition you have here performances of such accuracy of intonation, impeccable balance, an ensemble that sounds as if one mind controlled the four parts, and beauty of tone rarely produced with such consistency.

The Italians have their own ideas about how these quartets should go. Those wedded to a more orthodox approach may express slight disapproval of an occasional passage or even movement. But there is nothing eccentric in their departure from convention. For the most part these differences are only a matter of a slight change of tempo here and there, but repeat them and you will discover the logic of the players' treatment.

To sum up, the almost inexhaustible merits of this performance would lead to a tiresome string of superlatives. But one word of warning. Before you start to play this cassette turn your volume down just a trifle because they are recorded with so forward a presence that this reduction in volume will make the outstanding engineering just that wee bit more suitable for chamber music played in a domestic music room. Very, very highly recommended.

☆ ☆ ☆

BARTOK — Violin Sonata No. 1 played by Isaac Stern (violin) and Alexander Zakin (piano).

BERNSTEIN — Serenade for Violin Solo, Strings and Percussion. Stern (violin) and Leonard Bernstein conducting the Symphony of the Air. Odyssey Mono Disc DA 5121.

My pressing of this disc is in mono, which perhaps explains why the solo violin in the Sonata sounds forward enough to almost dominate the entire work. But according to Bartok authority Halsey Stevens "the province of the piano (in this work) is to underline, to intensify with penetrating comment, to elucidate".

Though it is a fairly early work — first performed in 1922 and at that time thought by many musicians to be deliberately harsh (as were many other pieces dating from this period) — nowadays it would be summed up simply as one of Bartok's more difficult works to assimilate at first or second hearing. The first movement has many highly impassioned moments which Bartok contrasts with other elegiac sections. In the second of these he gives what I think is the first hint of his later nocturnal slow movements. The adagio, which begins with a long unaccompanied violin solo, is in the form of a poetic meditation, though it's a rare bar that could be described as mellifluous.

The exhilarating finale in, not unexpectedly, rondo form, is in very fast dance time. Indeed there are times when it seems to be getting along like a little two-stroke motor bike. There are hints, especially in the adagio, that Bartok was beginning to be influenced by the Second Vienna School, a practice he discarded in his later, more important works.

Stern again demonstrates his complete mastery of his instrument and his musicianly insight into the composer's intentions, no matter what the style or period. Needless to say it is tremendously difficult to play — especially as Stern plays it — without a single falter. His pianist, Alexander Zakin makes a perfect collaborator along the lines set out by the Stevens' statement quoted above. Altogether a work every Bartok student should own.

The Bernstein Serenade is altogether different, lacking Bartok's strong individuality and originality. In this, too, the violin is often a bit too far forward. There are sections when it sounds like Bernstein's memory served him too well, as if he chose bits of Stravinsky's "Symphony of Psalms" to hang a suite on to.

In the sleeve notes, Bernstein explains that though the "Serenade" is without a program it is based on his rereading of the "Platonic Dialogues", and the various movements are headed by the names of some of the great Ancient Greek philosophers and playwrights. As usual Stern's playing is of almost uncanny accuracy and the whole performance is technically excellent.

* * *

POULENC —Flute Sonata orchestrated by Sir Lennox Berkeley.
IBERT — Concerto for Flute and Orchestra.
FAURE — Fantaisie.
CHAMINADE — Concertino. RCA Red Seal Stereo VLR1 7149. Also issued on cassette.

If you're looking for novelties — and who isn't in these days of a catalog bursting with so many different performances — this disc should, if acquired, provide a happy occasion. Here you have novelty combined with James Galway's inspired flute playing.

The weightiest of the four pieces offered here is, paradoxically, the "Poulenc", originally composed as a sonata for flute and piano, but in this version admirably scored by Lennox Berkeley. It is in three movements in typical "Poulenc" style, so typical that there is more than a usual likeness between the three sections. A practised ear can immediately identify the composer by his bitter-sweet tunes, even the "Finale" which shows influences of Stravinsky in its rhythmical treatment.

Next I would put the Ibert, composed as a test piece for the Paris Conservatoire. This perhaps explains the diabolical difficulties to be overcome in the solo part which, however, Galways plays with as much ease as if he were running through a set of scales. If you know Ibert's "Divertissement", you will be aware of what to expect from this witty and ingenious composer. Here again, as in all the four items on this disc, Galway's playing is peerless. Not a note out of place — or out of tune — and an incomparably beautiful tone.

It is such a long time since I came across the name of Cecile Chaminade that I thought her mostly tuneful, if simple, music must have disappeared for ever. But here she is again and welcome, too, in a one movement piece of no great significance but skillfully designed to provide the soloist with plenty of virtuoso work. It is somehow reminiscent of an Edwardian ladies' tea party, though without muffins for its style is always echt-French.

To complete this amiable recital you have a two-movement piece by Faure, the first slow and the second contrastingly fast. The first has all Faure's characteristic smoothness and lack of agitation; the second is consistently easy on the ear.

Now in consequence of my being musically something of a Francophile, I may be expressing more enthusiasm for these trifles than is their due. I personally found them all delightful — if a little nostalgic — but whatever your opinion of the compositions you cannot fail to be enchanted by Galway's presentation of them. And he is provided with exemplary, idiomatic accompaniments by the Royal Philharmonic Orchestra under Charles Dutoit.

If you're looking for a disc of sheer escapism here it is. The engineering is fine.

Tchaikovsky: Aurora's Wedding Ballet Music

TCHAIKOVSKY — Aurora's Wedding Ballet Music played by the National Philharmonic Orchestra, conducted by Leopold Stokowski. CBS Stereo Disc SBR235900.

Although Tchaikovsky composed no ballet entitled "Aurora's Wedding", the name is familiar to all balletomanes. Musically it comprises much of the music the composer provided for the many divertimenti that go to make up the last movement of the full ballet "The Sleeping Beauty" which, if I remember rightly, was first given in Australia just before the war by the de Basil Company with Dorati conducting. The music was also very well played on a 78 conducted — and I am again relying on my memory — by Eugene Goossens. This version won great popularity before the introduction of LP.

As to Stokowski's performance, one can only marvel at the vigour of this 95-year-old conductor, even as early as the first bars of the introduction, and his control of the orchestra all through. Typically, Stokowski "mucks about" with parts of the score, taking what might well be described by some listeners as unpardonable liberties with what appears on the paper. Many of his tempos are faster than when used in the ballet. Indeed, I cannot imagine dancers ever fitting the choreography to the speed of the music. This cuts out some of the effectiveness of an occasional slow, luscious melody, but Stokowski balances this by introducing some of his own elsewhere.

There are moments of very great beauty; for instance, a solo clarinet passage supported by whispered harp passages. I found this a true delight. Extra loud sections are compensated for by playing of almost unimaginable delicacy elsewhere.

"Aurora's Wedding" was one of Stokowski's last recordings and, again from memory, I must add that there is an occasional incident which I cannot recall having heard before. But again I must admit to relying on my memory because though I thought I had complete recall of the score I didn't have one available when listening to this new performance.

Although some musicians may resent Stokowski's occasional extravagances in so many of the works he recorded from time to time, one must always remain grateful to him for the enormous amount of work he put into the continuing improvement of recording techniques during his long and undoubtedly great career.

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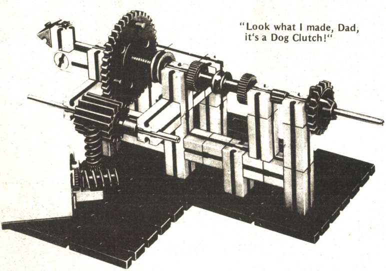

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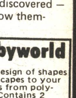

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The unique ambience of a large Cathedral is beautifully captured in this record of the Choir of Worcester Cathedral, directed by Christopher Robinson and the organ by Harry Bramma.

The choir render two versions of the Magnificat and Nunc Dimittis, in E by S. S. Wesley and in G. by Howells and E. Day's treatment of Psalm 84. The other Hymns are: Thou Wilt Keep Him by S. S. Wesley — Evening Hymn by Gardner — The Lord Is My Shepherd by Stanford and All My Hope On God Is Founded, by Bridges and Howells.

The whole performance is a delight and the quality is excellent. The record would make an ideal gift for anyone even remotely involved in liturgical music as distinct from 'Gospel' type recordings. Indeed, the World Record Club does a great service for what could be regarded as minority tastes, as they carry a range of liturgical music of most major faiths, all of it of high quality. (N.J.M.)

World Record Club recordings reviewed in these columns can be obtained only through the Club, membership of which involves purchasing not less than one record per year. For details: World Record Club Pty Ltd, 605 Camberwell Road, Hartwell 3124. Tel. (03) 29-3636.

THE LORD MAKES ME HAPPY. The Children of Light, arranged and conducted by Bob Krogstad. Stereo, Milk & Honey MH-1009. (From S. John Bacon Pty Ltd, 12-13 Windsor Av, Mt Waverey, 3149. $7.95)

Happy is the title and happy is the sound of this highly listenable album, featuring modern songs from the Singspiration Music organisation. It contains elements for everyone, with mainly close vocal harmony that will rest easily on older ears, but backed by accompaniments that are modern and rhythmic. They range through to soft rock, that will please but never offend.

Diction, too, is good, making it an easy matter to keep track of the lyrics:

The Lord Makes Me Happy — Brand New Day — I Will Sing The Mercies Of The Lord — Jesus Is A Never-Failing Friend — Now Let This Be The Day — Psalm 103 — Jesus Took My Sins Away — He That Believeth — Don't Forget His Love Today — He Is Our Peace — Rest In His Love and Abide.

It would appear from the credits that some of the music was laid down at Wembley, England, some of the vocals added in Chicago, and remixing and mastering done in two other centres in California. The important thing is that the end result sounds fine: well balanced, clean and excellent listening. (W.N.W.).

☆ ☆ ☆

ETERNAL FATHER. Chapel Music from the United States Naval Academy. Volume 1. Stereo, Richardson RRS-1. (From M.R. Acoustics, P.O. Box 110, Albion, Qld 4010).

Richardson is an American label, issued particularly with the audiophile in view.

The music on the album has been selected from items taped over a 3-month period and would seemingly represent highlights from the worship services. It is sufficient to say that the protestant chapel choir under John Talley is of a high standard, as is the playing of James Dale at the huge Moller organ. I use the word "huge" advisedly. The specifications would seem to suggest five manuals, pedals with access to 27 voices including a 32ft Resultant, and an Antiphonal pedal.

Side 1 is predominantly choral, although the first track "Psalm 1" (Cesar Frank) opens with as profound organ bass as you are likely to hear anywhere on record. Other choral items include: Sing To The Lord — If Ye Love Me — Cantate Domino — Christ To Thee Be Glory — Bless The Lord O My Soul — Let Nothing Ever Grieve Thee — Eternal Father.

Side 2 is all organ: "Symphonie Pour Grand Orgue V1, Final" (Vierne) in which the massive resources are displayed. "Tambourin" (Rameau) a brief and delicate item involving the choir division flutes. "Chorale Prelude on O Sacred Head Surrounded" (J. S. Bach) flutes, oboe, diapason. "Neuf Pieces Pour Grand Orgue III, Chant de Paix" (Langlais) tiny flutes against gentle string. "Trumpet Voluntary" (Stanley) as you would expect it, full of power and bite.

The sound is very clean but be prepared for an enormous contrast in level and complexity between various items as, indeed, there would have been at the original presentation. And especially between the Vierne Symhony and Langlais' "Neuf Pieces". (W.N.W.)

Instrumental, Vocal and Humour

HEADS. Bob James. CBS Records. Stereo SBP 237088. Also on cassette (PC 7088).

This rather interesting jazz session from Bob James includes six tracks in all, some known and some not so well known. A wide variety of instruments is featured in the recording, including acoustic piano, alto sax, electric guitar, flute and trumpet, to name just a few.

Track titles are: Heads — We're All Alone — I'm in You — Night Crawler — You Are So Beautiful — One Loving Night.

In summary, this album could be well worth a listen if you're into jazz. Others will find little to enthuse about. Recording quality is excellent, with good stereo spread. (G.S.)

☆ ☆ ☆

THE GLORY OF HANDEL AND CORELLI. The Philadelphia Orchestra conducted by Eugene Ormandy. CBS Gems from the Classics, stereo GM 517.

This is a very pleasant recording of some well-known 18th century orchestral music by Handel and Arcangelo Corelli, played by the highly esteemed Philadelphia orchestra under Eugene Ormandy. Three works are played, two of which are suites from Handel's "Music for the Royal

---

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards(D.W.E.), Greg Swain (G.S.), and Danny Hooper (D.H.).

LIGHTER SIDE — Continued

Fireworks" and the "Water Music", and the third suite from Corelli's Sonatas for Two Violins and Cembalo, Opus 5. The Royal Fireworks suite is arranged by Sir Hamilton Harty, the Water Music suite by Eugene Ormandy himself, and the Corelli suite by Ettore Pinelli.

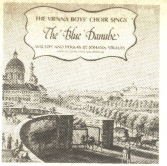
The performance of these good-natured and sprightly works is a little restrained, but not enough to make them ponderous. The orchestra is well balanced, with the various parts clearly distinguishable even in the forte passages. The recording is fine, too. In short, a most enjoyable recording if you're at all partial to this music. (J.R.)

☆ ☆ ☆

THE BLUE DANUBE. The Vienna Boys' Choir. RCA Red Seal stereo VRL1-7160.

According to the sleeve notes accompanying this album, there are actually four Vienna Boys' Choirs, each with 22 boys. They have their own full-time boarding school where they receive normal education in between touring engagements.

On this album, the Vienna Boys' give engagingly fresh renditions of waltzes and polkas by Johann Strauss. It really is a pleasure to hear a performance by such a rigorously trained choir. Recording quality is good. (L.D.S.)


THE VIENNA BOYS' CHOIR SINGS
The Blue Danube
WALTZES AND POLKAS BY JOHANN STRAUSS

WEST 8th STREET on Castle Avenue. Okihiko Presents. Stereo, Audio Lab ALJ-1052. (From M. R. Acoustics, PO Box 110, Albion, Qld 4010).

Here's another one of the Audio Lab series, which was first featured in last month's issue. Like the two albums there reviewed, this one is also to the soft light and sweet music formula, featuring a four-man Japanese group with tenor sax, piano, guitar and double bass.

The ten tracks, adding up to over 20 minutes per side are: I'm Glad There Is You — You Are Too Beautiful — I'm Getting Sentimental Over You — But Beautiful — Mean To Me — 'Tis Autumn — If You Could See Me Now — Blue and Sentimental — Candy — Street of Dreams

In keeping with the sentimental theme, Kosnosuke Saijoh resorts frequently to a really breathy sax. sound, which is perhaps a lot more intimate via the Audio Lab recording than it would be in a cocktail lounge. But, by contrast, the harder blown notes have real "bite". It's very clean sound from a very quiet surface and potentially pleasant listening for those who are partial to well played cocktail lounge music. (W.N.W.)

☆ ☆ ☆

DJANGO & STEPHANE ORIGINALS. World Record Club Retrospect. WRC 02528.

Recorded in early 1949 and unreleased until now, this generous album with fourteen tracks from the founders of 'The Quintette of The Hot Club of France' makes a splendid showcase of their talents.

Django Reinhardt was one of the greatest jazz guitarists ever known and his partner, Stephane Grappelly, who has been in Australia in recent years, together with Gianni Safred, piano, Carlo Pecori, Bass and Aurelio De Carolis on drums, offer these tracks: Over The Rainbow — Swing 39 — Vous Qui Passez Sans Me Voir — Nagasaki — My Melancholy Baby — Bolero De Django — Liza — Minor Swing — Sweet Georgia Brown — Just a Gigolo — What Is This Thing Called Love — My Blue Heaven — Clopin Clopant — Rosetta.

The record is labelled 'Stereo' but it must be of the reprocessed kind and does little to enhance the quality, which is fair only. (N.J.M.)

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Brief details of catalogue:

ALC-1002	Czerny (Meiko Miyazawa)	25 piano studies op 748.
ALC-1005/6	Burgmuller (Meiko Miyazawa)	Studies etc. Beethoven, Diabelli
ALJ-1007	Collaboration	Jazz-Quartet plays Autumn Leaves etc.
ALJ-1009	"Music"	Jazz-Quintet plays So In Love etc.
ALJ-1012	Side By Side	Jazz-Piano plus-Stardust, Tea for 2.
ALC-1013	Czerny (Meiko Miyazawa)	Etudes op 849.
ALC-1015	Meiko Miyazawa Plays Chopin	Fantasie Impromptu, Mazurka etc.
ALC-1016	Tokyo Academy Ensemble	Stamitz, J. C. Bach, Mozart Cembalo Con.
ALC-1017/8	Sonatinen	Meiko plays Kuhlau, Dussek, Clementi.
ALJ-1019	Right-Oh	Jazz Quartet-All the things you are.
ALJ-1021	Everything Happens To Me	Jazz Quartet-On Green Dolphin St. etc.
ALC-10124	Beethoven (Hans Kann)	Waldstein and Funeral Sonatas.
ALC-1025	Katin Recital	Peter Katin plays Chopin & Schubert.
ALJ-1026	Portrait 2 (Kunihiko Sugano)	Piano — Moonlight in Vermont etc.
ALC-1027	Kaneko Yanagi Japanese Song Album	Sara, From Koka 25 etc.
ALC-1028	Meiko Miyazawa Piano Recital	Live recording, Faure, Ravel, Chopin etc.
ALC-1029	Mozart String Trio	Divertimento in E flat K.563.
ALJ-1030	Get Happy (Takeshi Inomata & Friends)	Jazz — Witch Doctor, Caravan etc.
ALJ-1031	Concert Tour In Kyushu	Jazz-Trio play Fly Me To The Moon etc.
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ALJ-1042	Side By Side 2	Jazz-Piano plus-If I Had You etc.
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ALP-1056	Emotion	Jazz Quartet play Charade etc.
ALJ-1057	West 8th Street On Castle Ave. Vol. II	Jazz Quartet play More Than You Know.
ALC-1058	Mozart Piano Concertos	Meiko plays Coronation K537, K488 in A.
ALJ-1059	The Dialogue	Dialogue with bass, flute, guitar, etc.
ALJ-1060	Sweet And Lovely	Piano & Bass play Winter Wonderland
ALJ-1047	Side By Side Vol. 3 (Kazuo Yashiro)	Jazz-Piano, After You've Gone etc.
ALJ-1014	Portrait (Kunihiko Sugano)	Jazz-Piano, Summertime, Lonely Blues etc.

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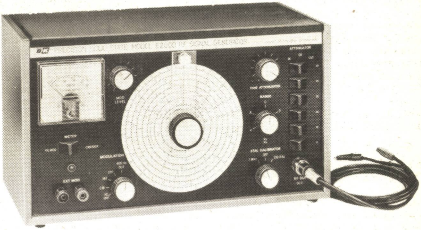

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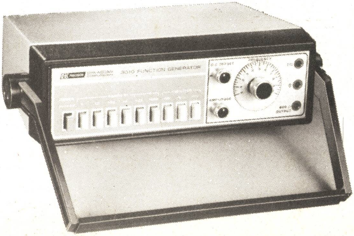

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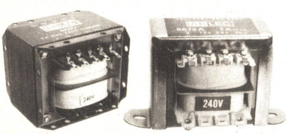

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THE LIGHTER SIDE — Continued

THE MUSIC OF COLE PORTER. Frank Chacksfield and his orchestra. Stereo, World Record Club WRC R-03297.

If you don't already have one, here's an excellent album to remind you of the music of Cole Porter. The arrangements are generous, giving a predominantly lush sound, but interspersed with delicate solo instrumental passages — all in the Frank Chacksfield style.

The ten numbers are: Night And Day — Begin The Beguine — I Love Paris — My Heart Belongs To Daddy — Ev'ry Time We Say Goodbye — Wunderbar — Just One Of Those Things — You'd Be Nice To Come Home To — Friendship — In The Still Of The Night — Blow, Gabriel Blow.

Recorded originally by Decca, the sound is clean throughout and will stand being played at a good level if you want the orchestra really to step out. Alternatively, it's quite pleasant turned down to act as background. This one should be very popular. (W.N.W.).

☆ ☆ ☆

TURNING POINT. John Coltrane. Bethlehem mono BCP 009. $4.99. Distributed by Australian Record Co Pty Ltd.

By any standard, saxophonist John Coltrane's career was short. He started with the Miles Davis' quintet in 1955 and died in 1967. In that short time he established himself as a leading jazz saxophonist whose name will always be remembered. All the tracks on this album are from the period at the end of 1957. Comprehensive notes detail the origin of each track.

Recording quality is quite good (it is mono) so that this is a good album for any budding jazz collector. A further attraction is the low price.

There are seven tracks with an overall playing time of 35 minutes and 43 seconds: Pristine — If I'm Lucky (I'll Be The One) — Tippin' — Midriff — Turtle Walk — Love And The Weather — The Outer World. (L.D.S.)

☆ ☆ ☆

STEVE KAHN, TIGHTROPE CBS 237087 Stereo.

Seven tracks of very exhuberant jazz-rock make up the content of this enjoyable record, Steve Kahan's first solo album. He features on guitar on every track with other musicians, such as Jeff Mirinov, Don Grolnick, Will Lee, Bob James, Ralph MacDonald, Randy Brecker, Steve Gadd, Dave Sanborn and MIKE Brecker.

The tracks are: Some Punk Funk — Darlin' Darlin' Baby — Tight Rope — The Big Ones — Star Chamber — Soft Summer Breeze — Where Shadows Meet.

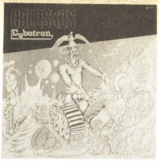
The quality would put this record into the demonstration disc category, providing your system can handle some of the bass. It's fairly high level recording on most tracks. (N.J.M.)

☆ ☆ ☆

COLOSSUS. Cybotron. Champagne Records CHA 7004 (from Champagne Records, 2/609 St. KILDA Road, Melbourne 3004).

Cybotron are a three man Australian electronic band, who use a vast array of synthesizers, mellotrons, pianos, organs, saxophones, and percussion instruments to produce sounds very similar to those produced by Hawkwind and Tangerine Dream. Members are Geoff Green, Colin Butcher and Steve Braund.

As one has come to expect with electronic music, there are a wide variety of unique sounds, with lots of slowly varying repetitive riffs and melodies. The stereo effects are very impressive, without being too much of the "ping pong" style.



I found the last track on side two, titled "Raga In Asia Minor" to be the most impressive, with the title track running a close second. Overall, the album is an impressive effort, and would be worth a listen if you are keen on electronic music. Technically, the recording is excellent, and will fully exercise your stereo system, as well as your ears. (D.W.E.).

☆ ☆ ☆

THE VOGUES GREATEST HITS. The Vogues. SSS International Records. Festival release L25290.

As may be judged by the title, this album features some of the old hits of The Vogues, a male vocalist trio popular around the mid-1960s. Their music reflects the pop sound of that era and, as such, will mainly be of interest to those who remember the songs.

Tracks of note include "Groovin", "What a Day for a Daydream", "You're the One", and "Happy Together", the latter made popular by The Turtles.

Recording quality is only fair by modern day standards. (G.S.)

☆ ☆ ☆

POWER & LOVE. Manchild. United Artists. L 36445. Festival release.

Manchild is an American group, formed in 1974, comprising seven talented male musicians. Individually, Manchild is: Reggie Griffin — tenor and soprano saxophones, guitar, clarinet and vocals; Anthony Johnson — bass guitar; Keith Ferrell — lead vocals, clarinet; Chuckie Bush — Fender Rhodes, piano, synthesizer and vocals; Kenny Edmonds — guitar and vocals; Robert Parson — drums; Daryl Simmons — congas, bongos, percussion and vocals.

The eight tracks on the album possess a diverse sound of rhythm and blues, soul ballads, jazz and part disco. Altogether, the members of Manchild are in total harmony and the album rates fairly well. (D.H.)

☆ ☆ ☆

FAITHLESS. Marianne Faithfull. Nems Records L36545 (Festival release).

Life has come full circle for Marianne Faithfull. As a young convent-educated 17-year old, she recorded a "As Tears Go By", and reached the top ten on the charts. Since then she has toured with the Hollies, branched out into acting, and then into heroin.

However, she has now overcome her addiction, and has returned to the recording studio. The resulting album is superb, and I am sure it will remain one of my favourites for a long time to come. Her voice has deepened slightly since her earlier hits, but has lost none of it's fragile beauty.

The twelve tracks on the album range from pure country to straight rock, and include compositions by Jackie De Shannon, Allen Reynolds, Waylon Jennings, Jessi Colter and Bob Dylan, as well as a couple by Marianne. All tracks are enjoyable.

Technically, the record is excellent, with very crisp highs and minimum surface noise. This is one to be recommended to all country rock fans. (D.W.E.).

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75F12	2.80	ET1124	2.50	ET122	3.00
75CL9	2.50	75PC12	2.50	ET121	2.50
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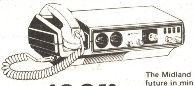

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The Australian CB SCENE

QUESTIONS AND ANSWERS: EMERGENCIES, ANTENNAS, POWER SUPPLIES, etc

Q: I often become involved in search operations in my own state (Qld) where a great many recreational hikers become lost in broken country. It would save trouble and lives if they could own or hire a beacon transmitter, with as much power output as possible, which would automatically transmit a tone for approximately five seconds in every 30 or so. Perhaps it would be possible to devise a plug-in unit which would enable a standard CB transceiver to fill the role.

A: Superficially, it sounds like a good idea but, in practice, any such unit would probably have to be a light, hand-held portable device, with whip aerial, and with no more power output than is available from the usual hand-held CB transceiver. In broken country, the range of these can be very limited and, while a beacon may simplify the searcher's problems within the last mile or so, the idea of maintaining surveillance over a large area would be dubious. But, then again, matters might be improved if the hikers also carried a long wire to throw over a dry tree.

Q: If the beacon idea is practicable, what would be the chances for a cheap, direction-finding portable receiver to help spot them?

A: We imagine that it would be possible to fit a simple bidirectional loop to a sensitive switched channel CB receiver, or to a preamplifier ahead of such a receiver to give some indication of direction. Whether it would pick up a "beacon" signal would depend partly on the strength of that signal and partly on the channel being clear of other carriers, particularly during periods of anomalous propagation. The long and short of it seems to be that there may be occasions when CB type gear could help hikers, either not to get lost, or to be found if they do. But we doubt very much whether it could be relied upon.

Q: I have installed a commercial 5/8-wave base loaded antenna at my base station and have noticed a gradual deterioration in the SWR. What would cause this?

A: We have heard this sort of thing blamed on to water seeping into the coaxial cable but it doesn't fit your description of a "gradual deterioration". If cable can get wet, it should also dry out again in the warm sun and return to normal. Even so, the wise CBer will wrap all connections with adhesive tape to make them as watertight as possible. To check your cable, however, connect a 50-ohm load to the far end in place of the antenna; you can make one or buy one for a few dollars. If the SWR returns to normal, you can stop blaming your cable.

Another possibility is corrosion in the plug and socket (especially if they are not wrapped) or corrosion to do with the antenna itself. All you can do is to dismantle it as far as possible and check.

But while doing this, check something else; it can apparently happen all too easily: These antennas are made up of tubes which slip inside one another and are held in position with a couple of self-tapping screws. With constant exposure and vibration, the screws can rust and shear, or else drop out altogether. This allows the section gradually to telescope, so that the antenna gets progressively shorter — the symptom you describe. Check, re-drill and replace the screws as necessary. We also suggest splitting the top centimetre or so of the main tubes with a hacksaw cut and tightly compressing with a screw type automotive hose clamp. If you're worried about rusting, paint over the screw heads and clamps with clear lacquer.

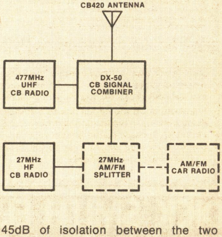
Q: An instruction sheet from a CB antenna manufacturer makes a special point that the antenna coax should be 3.65 metres (12ft) long, or a multiple of that length. An amateur friend maintains that if the antenna was really 50 ohms, as it is supposed to be, the cable

Dual Frequency CB Whip from Scalar

Designated as type CB420, a new dual frequency whip has been announced by Scalar Industries Pty Ltd, intended to provide simultaneous coverage of the UHF 470MHz band and the 27MHz band. It should be ideal for those who may wish to add a UHF facility to a vehicle already fitted out for 27MHz operation.

All that is necessary is to replace the existing HF antenna with a Scalar CB420 and to insert a Scalar DX50 Signal Combiner. With this arrangement, the transceivers may be used separately or simultaneously, on either receive or transmit without interraction.

In fact, with the addition of a Scalar 26MHz/FM/AM splitter, as indicated, the same antenna can be made to serve an AM/FM car radio as well.



The DX50 CB Signal Combiner has a rated insertion loss of 0.6dB at 477MHz, and 0.3dB at 27MHz, with 45dB of isolation between the two paths. VSWR is 1.2:1 for both bands and the power rating is 25W.

Details from: Scalar Industries Pty Ltd, 18 Shelley Ave, Kilsyth, Vic 3137. Telephone (03) 725 9677.

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TECHNICAL DATA

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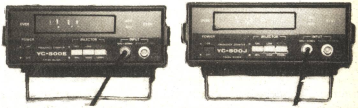
Input 2 — 50 MHz to 500 MHz.
Accuracy:
YC-500-E model — 0.02 PPM;
YC-500-S model — 1 PPM;
YC-500-J model — 10 PPM.
Display Digit: 6 digits.
Display Time:
0.1 or 2 seconds.
Counting Time: 0.001 or 1 second.
Input Voltage:
Input 1 — 25 mV to 20 V RMS;
Input 2 — 100 mV to 2 V RMS.
Input Impedance:
Input 1 — HIGH 1 Meg, LOW 50 ohms;
Input 2 — 50 ohms.
Input Capacitance:
Input 1 — Less than 20 PF;
Input 2 — Less than 20 PF.
Operating Temperature: 0 to 40°C.
Power Requirement:
AC — 100/110/117/200/220/234 V;
AC, 50/60 Hz;
DC — 12 to 14.5 volts.
Size: 220(W) x 80(H) x 235(D) m/m.
Weight: Approx. 3.2 kg.



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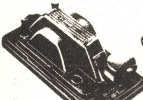
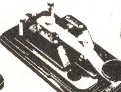
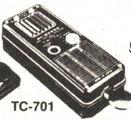
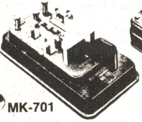
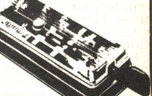

HK-707


HK-708


TC-701


MK-701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feeding it could be of any length. Who is right?

A: Your amateur friend is certainly not wrong but it is necessary to remember that amateurs are able to "follow the book" fairly closely. Their antennas are mostly in fixed situations, with specific dimensions and predictable resonance and impedance characteristics.

On the other hand, the average 27MHz mobile whip is a massive compromise. It is less than a quarter-wavelength overall, and is artificially elongated by helical winding. It operates against a vehicle body, as a kind of ground plane, but the vehicle body varies in shape and size and is almost always inadequate.

By largely empirical means, the CB antenna manufacturer juggles the pitch and length of the helix in the hope that, when it is mounted in an "average" manner on an "average" vehicle and trimmed from the top, that it will ultimately achieve resonance and an effective 50 ohms impedance at the fixed feedpoint.

This desirable condition is assumed to be achieved when a satisfactory reading is obtained on an SWR meter inserted (usually) between the transmitter and the cable. No access is available to the tuned output circuit of the transmitter feeding the cable.

The enforced compromises and approximations are in sharp contrast to the usual amateur text-book installation but CB mobiles still seem to work, even if in sometimes indifferent fashion.

A cable 3.65m long represents an electrical half-wave at the operating frequency (27MHz) and will exhibit the usual property of a half-wavelength of cable: it will present, at the transmitter end, the exact impedance which it sees at the load end, irrespective of the nature of the load — matched or unmatched.

Presumably the manufacturer believes that this condition will offer the least ambiguity when the CBer has to go through the exercise of snipping the top of the antenna, guided only by the usual SWR meter.

Whether or not this is a valid point of view would be open to some debate but one thing seems certain: if and when the CBer managed to get the antenna resonant and to 50 ohms impedance, he should be able to substitute any likely length of 50-ohm cable for the original piece and never see the difference!

If you or your amateur friend want to take the matter any further, we can only suggest that you get in touch with the manufacturer and ask the reason.

Problems for CREST at Mackay

Dear Sir,

Having been an avid reader of EA from far back as the "Radio & Hobbies" era, I was literally shocked and dismayed at the news in your Editorial Viewpoint in June.

I have been the Mackay Operations Director for CREST since November 1977 and, before that, monitored 27.065 for a couple of months. We have coped with some notable long-distance emergency calls and get a great deal of satisfaction from assisting the community.

Over the past couple of months, however, a few irresponsible CBers have been frustrating our efforts. Recently, for example, they jammed 27.065 continuously for three hours, with "accessories" that even interfered with local TV reception.

I wonder whether responsible magazines like yours can help get the message across that CREST and affiliated voluntary groups of monitors are not trying to assert ownership to 27.065 for their own ends. They are merely trying to maintain a listening watch FREE for CBers who may need assistance.

Unless attitudes improve, I can readily accept that the last paragraph in your Editorial Viewpoint could well become a reality.

MALCOLM K. LOWE,
Director, CREST,
Mackay Division, Qld.

Q: How rigid are the maximum current ratings of CB power supplies? Could they be damaged by drawing more current than they are rated to deliver? Is there any easy way of modifying a supply to up its rating?

A: Let's take the last question first: In the highly competitive CB market, it is fairly safe to assume that CB power supplies will contain components which are no larger (and therefore no more expensive) than necessary to meet the rating. Or you can look at it another way:

If it were possible to increase the maximum current rating of a supply by simple means, you can rest assured that the manufacturer himself would have taken the necessary steps in order to gain a marketing advantage.

For all practical purposes, the answer to the last part of your question is therefore "no".

Nor can we make very encouraging noises about deliberately overloading supplies.

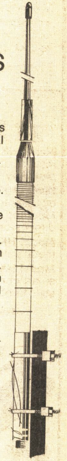
In the valve era, power supplies employed relatively simple circuitry. The regulation wasn't very good and voltage came down as the current load increased. But one could take liberties with them, provided one made sure that the components didn't overheat — and that was a relatively gradual process.

However, modern low voltage power supplies employ more elaborate circuitry to ensure adequate voltage regulation, and to secure a suitably low ripple content without having to use filter chokes and prohibitively large filter capacitors. To safeguard this extra circuitry, the supplies usually include some kind of protection against overload, ranging from critically proportioned fuses to automatic overload protection; the latter reduces the output voltage in the event of any attempt to draw excessive current.

If you deliberately overload such a supply, the first thing you may notice will be a reduction in the output voltage with a sharp increase in the ripple content — perhaps evident as a hum on your carrier. Beyond that, a fuse may blow. If you replace the fuse with a heavier one and persist with the overload, you can expect trouble from the filter or regulation circuitry — and that won't happen slowly.

One other point is worth keeping in mind: budget priced CB power supplies may be rated with intermittent

NEW COAXIAL CB DIPOLE FROM TANDY ELECTRONICS



A new Archer Coaxial dipole antenna released by Tandy Electronics should appeal to those CB operators who might find it impractical to instal the usual 5/8-wavelength antenna at their base station. Known as the Archer "Crossbow" (Cat. No. 21-965), the new antenna does not need ground-plane radials and is not critical in terms of mounting situation. It is of 2-section construction with a white fibreglass body. Height is approximately 5.6m and the weight 3.7kg. Natural resonance is 27.1MHz and nominal impedance 50 ohms, making the antenna suitable for use with RG-58-U or RG8-U or other 50-ohm coaxial cable. Price, complete with mounting hardware, is $69.95. For details: any Tandy Electronics store or direct to Tandy International Electronics Pty Ltd, 280 Victoria Rd, Rydalmere, NSW 2116.

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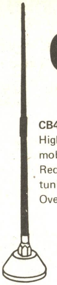

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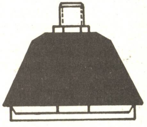

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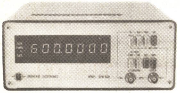

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Also available is the DFM 100, this is priced even lower than the 600 but still enjoys many of its excellent features — including 240V or 12V DC operation.

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use in mind — on the assumption that the average operator will talk a bit and listen a bit. Such supplies might be hard put to cope with continuous operation at full rated current, let alone trying to run them above rating!

In short, our general answer to the question must be: treat the maximum current rating seriously and stay within it.

Q: I came across a statement in the sales blurb for a power supply to the effect that electronic overload protection is not suitable for use with CB transceivers; that fuse protection is better. Why would this be so?

A: With electronic control, any increase in output current above a certain designed maximum feeds a signal to a control transistor, which triggers other transistors to effectively open the DC output circuit. The system can be very fast acting, thereby affording a maximum degree of protection both to the supply and to the equipment drawing the excessive current.

However, in being set up to respond rapidly to an overload signal, the controlling transistor may conceivably respond to a stray transient from somewhere or to a burst of RF energy, and mistakenly switch off the supply.

A fuse is not affected in the same way and, of course, a fuse system is a lot cheaper. But, equally, fuses are not as precise; they require a larger overload and take longer to "blow". Alternatively, if their rating is reduced too close to the working current, they fatigue and blow spontaneously without significant overload.

There is also the matter of the transceiver itself. If a transceiver produces current transients by virtue of its design, or the way it is being used, it may have an undue tendency to trigger electronic protection. Or, again, the transceiver or the antenna feed system may inject more than a little RF energy into the power supply.

Frankly, we are inclined to think that this belongs more to the realm of what might happen than what does happen. Our own experience has been that the average transceiver, used with an average antenna system, and powered by an average commercial CB power supply works fine — irrespective of the protection system involved!

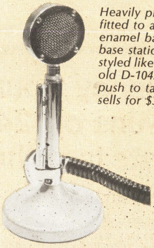
NEXT MONTH:

We plan to present a special article on the Trial and Novice Examinations — the logical stepping stones for CBers into the world of amateur radio.

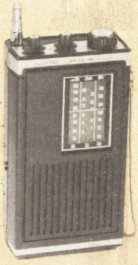
CB Equipment from Dick Smith Electronics

The "Bumblebee" AM CB transceiver is ideal for the operator who could be confused by non-essential knobs. Yet it uses modern circuitry, approved by the P&T Dept, offers excellent receiver performance and a full 5W power onall 18 channels. New price is $79.50 (Cat. D-1510).

At left, the "Wasp" AM CB transceiver has a LED channel readout in lieu of the more traditional calibrated knob, automatic noise blanking and limiting, and a fine tune control. The "Wasp" has full P&T approval, excellent performance. Special new price $99.50.



Heavily plated and fitted to a grey enamel base, this CB base station mic is styled like the famous old D-104. With a push to talk lever, it sells for $39.50.



The Alconic portable receiver offers normal AM and FM reception plus coverage of US CB channels 1 to 40. It sells for $29.50. (Cat. D2842).

Hifi interests oppose RFI legislation

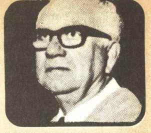
No less than three bills are currently in the US legislative pipeline, which would empower the Federal Communications Commission to specify minimum standards which would have to be met by all audio circuitry in respect to the rejection of potential radio frequency interference.

Backed strongly by Senator Barry Goldwater, himself an amateur radio enthusiast, the move follow a steep rise in complaints about interference from CB and other transmitters. In many cases, the problem is not with the transmitters at all, but with the audio equipment which is wide open to RF penetration.

In response, an alert has been circulated by the IHF (Institute of High Fidelity) objecting to their possible summary treatment by the nation's legislators. While they acknowledge that there is a problem and that the legislators might mean well, they claim that they are not the appropriate body to devise technical standards.

IHF Technical Director, Leonard Feldman, objects that "cures" which might be imposed by legislation may not always be the most effective ones open to engineers and that, further, they may adversely affect the performance of high quality equipment within its pass band.

AMATEUR RADIO



by Pierce Healy, VK2APQ

Forthcoming contests, novice syllabus, and RTTY news

Amateur radio abounds in contests and various types of operating awards. This month we discuss some of those sponsored by the W.I.A. and various district clubs.

The unique Remembrance Day Contest, sponsored annually by the Wireless Institute of Australia, will be held over the weekend 12th-13th August, 1978.

This contest is to perpetuate the memory of those Australian amateurs who paid the supreme sacrifice during World War II.

There is no outright individual winner in this contest but certificates are awarded to top scorers in each state division/call area for each section of the contest.

A perpetual trophy is inscribed with the name of the division whose members collectively, and in accordance with a formula, gain the highest number of points.

All amateurs, whether WIA members or not, may take part in the contest.

An appropriate address recorded by a prominent public figure will open the contest at 0800GMT Saturday evening. The contest will conclude at 0800GMT Sunday evening.

Rules and point scoring table were not received in time for inclusion in these notes. However, it is not likely that any major changes have been made to last year's rules. Help your local WIA division to have a chance to win the contest by sending in your contest log.

The VK/ZL/Oceania contest is jointly organised by the WIA and NZART and will be held early in October. A new section for RTTY operators is included this year for the first time. Rules are given in these notes.

Looking for awards? See details in club notes.

WIA NEWS

A Morse code and theory examination syllabus and study guide, for the novice licence, is now available from the WIA. This has been produced and published by the WIA and has been approved by the P&T Dept. It costs 65c and is available from the WIA, PO Box 150, Toorak, Victoria 3142.

A number of novice licensing questions have been discussed by the P&T Department-WIA joint committee. The vexed question of novice examinations away from capital cities was discussed and a press release from the department was promised. A request that the top limit for the novice section of the 80-metre band be 3625kHz has been made.

The Department has categorically stated that RTTY and SSTV modes were not authorised for novice licensees. The promise of reduced licence fees for pensioners is still under examination.

IARU NEWS: The president of the International Amateur Radio Union, Noel Eaton, VE3CJ advises that the WARC 79 advisory committee seems to have completed the preparatory planning phase and that it will be the basis of the actual team to represent the IARU at WARC 79.

The IARU group has produced a leaflet entitled "The Case for Amateur Radio" designed to assist amateur societies of developing countries in educating their national administrations on the need for the amateur radio service.

Arrangements have been completed between DARC (West German Amateur Radio Society) and the Radio Society of Sri Lanka whereby a number of DARC members had volunteered to participate in an amateur radio training course to be held in Colombo during October 1978. DARC volunteers will fly to Colombo and 50 per cent of the project expenses will be met by Region I, with further contributions from IARU Region III. The WIA executive decided that this was a most worthy cause, and donated $250.

RTTY NEWS

From a gathering of five RTTY enthusiasts twelve months ago, the NSW RTTY group has grown to over 250 members, including interstate operators. The upsurge in this mode has resulted from machines becoming available through disposal sources, the increasing number of RTTY operators in other countries, and the regular Sunday morning news broadcasts from VK2TTY at 10.30 am on 14.90MHz and 7.45MHz. Other reasons include the kits available through the group, and the work done by a lot of people in helping others.

During the year approval was given for the group to organise an RTTY section in the VK/ZL/Oceania DX contest.

The rules are as follows:

Date: 7th-8th October, 1978 (same weekend as the phone section of the contest).

Time: 1000GMT Saturday to 1000GMT Sunday.

Bands: All amateur bands 3.5MHz to 28MHz.

Classes: Three classes. (a) Single operator; (b) Multi-operator; (c) SWL operators. Logs of multi-operator stations must be signed by all operators, together with a list of their call signs. Logs of SWLs must contain both number sent and number received by the station logged. Incomplete loggings are not eligible for scoring.

Number exchange: Serial number will consist of (a) RST; (b) zone number and (c) time in GMT.

Scoring: As per the CARTG zone chart, multiplied by the number of continents worked (maximum 6). World stations add 100 points for each VK/ZL worked after the above calculations. A station may be worked only once on each band, but may be worked on another band for further multipliers.

Countries: Country count as per ARRL list of countries, except that each VK/ZL, JA and W/K districts count as separate countries. Contacts with one's own country count as zero points for multipliers.

Logs: Logs must show in this order: Date, time (GMT), call sign of station worked, serial number received, serial number sent and points claimed.

Closing date: Logs must be received

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

by 1st January, 1979. The address for the RTTY section is: S. E. Molen, 13 Pendle Way, Pendle Hill, NSW 2145, Australia.

Summary sheet: Summary sheet must show call sign of station, name of operator and address, bands used (a separate log is required for each band), the points claimed for each band, number of VK/ZL stations worked, total points claimed and signature/s. Multi-operator station logs must contain the signature and call sign of each operator.

Awards: Certificates will be issued for 1st, 2nd and 3rd places on world basis and 1st, 2nd and 3rd place on a country basis.

The judges' decision regarding placings in the contest will be final and no correspondence will be entered into regarding that decision.

The logs become the property of the contest committee on completion of checking.

Space does not permit reproduction of the CARTG zone scoring chart. Copies may be obtained from the Secretary, RTTY Group, Wireless Institute Centre, 14 Atchison Street, Crows Nest, NSW 2065.

Definition of single operator and multi-operator entries, as applied to international RTTY contests, are:

1. A single operator station is one where operation for the entire period of the contest is by the same person without any assistance whatever from any other person in technical matters, log keeping, check logging or any other contest function.

If this person uses a club or group station he, or she, should make the entry under his or her call sign and not use the call sign of the club or group.

2. A multi-operator station is one where a number of operators take turns in operating during the period of the contest and where assistance may be provided by others in log keeping, check logging and other contest functions.

In no circumstances should it be possible to use the station on more than one band at any one time. All operators concerned with the station must sign the contest entry with both name and call sign. It is not permitted for any of the named operators to operate from any other station during the contest neither is it permitted for the multi-operator station to engage in contacts with any of the named operators during the period of the contest.

Coming RTTY contests are: August — Scandinavian SARTG world-wide RTTY contest; October — Canadian CARTG and VK/ZL RTTY contest; November — German WAEDC RTTY contest; December — Italian Volta contest.

RADIO CLUB NEWS

RADIO CLUB DIRECTORY: Club secretaries are reminded that the 1978 radio club directory is now being compiled for publication in December, 1978.

Some clubs have already forwarded details. Use the same format as last year. Don't let your club miss this opportunity to make its existence known.

Send details now.

AUSTRALIAN LADIES AMATEUR RADIO ASSOCIATION: By a majority decision of almost five to one, members at a meeting on the 10th June, 1978 adopted the change in name of their association. Previously it was the LARA.

Details of ALARA may be obtained from the publicity officer, Heather Mitchell, VK3NFY, 3 Summerhill Road, East Brighton, Vic 3187. At the time of writing Heather had passed the AOCP and was awaiting her full call sign.

ORANGE & DISTRICT AMATEUR RADIO SOCIETY: Members of the society are setting out to take a very active part in the WIA at both state and federal levels.

WICEN activities continue to be a major interest. Exercises conducted in conjunction with local organisations are gaining appreciation and praise from those bodies. One such case was at a State Emergency Service conference held at Bathurst, with an impressive demonstration of amateur VHF communication using RTTY. Several of the delegates were surprised at the resources available through the amateur service.

For the next three years WIA federal contests will be the responsibility of society member Wally Watkins, VK2ZNW/NCU as federal contest manager.

On the 20th May, 1978, a meeting of amateurs in the western area of NSW was held at the Hillview property of Bruce Thomas, VK2FD. Thirty-one amateurs were present including members of the NSW division's council. Many aspects of Institute affairs were discussed.

For further information on the ODARS join the central west net on 3.572MHz each Tuesday at 8.00 pm.

CASINO AMATEUR RADIO CLUB: Formed in March, 1977, the club membership now stands at 20 and, until permanent club rooms can be obtained, operates from the treasurer's home at 69 West Street, Casino, NSW.

The club call sign is VK2AKB and meetings are held on the first Thursday of each month with practical and demonstration nights on the third Thursday of each month.

New members are always welcome, especially those wishing to enter amateur radio.

Membership enquiries may be made to R. I. Ashdown, 69 West Street, Casino 2470. Telephone (066) 62 3047. Or from the secretary, James Bates, VK2NRT, PO Box 404, Casino, NSW 2470.

ILLAWARRA AMATEUR RADIO SOCIETY: Members participated in a maritime mobile exercise to assist the local State Emergency Service during the annual fun afloat event, in which rafts were sailed across Lake Illawarra. The exercise was enjoyable and successful despite difficult conditions due to a public address system alongside the base station.

Detailed estimates have been made of the weight and best method of dismantling and moving the moonbounce dish antenna from Dapto to a new location where the possibility of vandalism will be considerably reduced.

Meetings are held on the second Monday of each month at 7.30 pm, at the Wollongong Town Hall meeting room.

WAGGA AMATEUR RADIO CLUB: Members are making every effort to ensure that the 1978 South West Convention is an outstanding success.

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YO-301	301 Series Monitorscope	$ 375
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YP-150	Dummy Load/Wattmeter	$ 99
FRG-7000	Digital Comm Rx	$ 685
TS-520S	120-10m 200W TCVR	$ 719

GREG WHITER VK3CA

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CO-AXIAL CABLE

RG-58/U	5.6dB/100 ft. 100MHz	$0.45/m
5D-FB	2dB/100 ft. 100MHz	$1.20/m
PL-259	Connectors	$1.10 ea.
SO-239	Sockets	$1.10 ea.

* * * * * *

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SWR-200 Osker Block SWR/POWER meter – **$69**

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HEAVY DUTY HELICAL WHIPS, 80–10 mx. – $29

BL-1A 5KW PEP 1.8 – 40 MHz, 1:1 Toroidal Balun. **$15.99**

A-248D 80/40/20 metre Trapped Dipole Antenna 18 m long. **$36**

20 Foot Tower Self Supporting **$75**

MC-801 Katsumi mic compressor – **$45.**

KB-105 80-10 METRE TRAPPED VERTICAL ANTENNA

The KB-105 is supplied complete with guy ropes and radial traps, which are optional extras with many other brands.

KB-105 80-10MX **$124**

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90 DAY LIMITED WARRANTY APPLIES TO ALL EQUIPMENT BUT DOES NOT COVER FINAL TUBES OR SEMI-CONDUCTORS. ALL OUR EQUIPMENT IS PRE-SALES CHECKED. WHERE AC MAINS OPERATED ARE WIRED WITH 3-CORE CABLES AND PLUGS.

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VHF/UHF Scanning Type Radio Broadcast Receiver

Bearcat® 210

The BEARCAT 210 is an advanced scanning receiver with digital frequency readout and push-button programming — no crystals required.

- **10 Channels within range 146-174 MHz, 416-512 MHz.**
- **Decimal frequency display.**
- **Push-Button Keyboard for easy frequency selection.**
- **Automatic track-tuning for optimum performance on all channels.**
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- **Automatic Search facility. Will electronically tune between selected frequencies, lock-on and display frequency of received signals.**

An advanced technology receiver providing manual or scanning type operation on up to 10 channels without the need for extra crystals. Ideal for professional, commercial or amateur use, or for Government agencies.

Easy to use. Select the 10 frequencies you wish to scan and punch them in on the keyboard. The decimal display shows each frequency selected. To change frequencies, just enter the new ones.

Automatic search lets you scan any given range of frequencies within a band. When the receiver locks-on to an active channel the decimal display shows the frequency. Automatic track-tuning ensures circuits are always peaked for any broadcast.

SPECIFICATIONS

Frequency coverage: VHF — 146-174 MHz, UHF — 416-512 MHz. **Sensitivity:** VHF — 0.6uV for 12 db SINAD, UHF — slightly less. **Selectivity:** Better than -60 db @ + or — 25 KHz. **Scan Rate:** 20 channels per second. **Antenna:** Telescopic (Supplied). Provision for external antenna. **Audio Output:** 2 Watts.

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Vic., 3182. Tel. 534 6036

AMATEUR RADIO

They are arranging a program to cater for the whole family. The dates are Saturday, 30th September and Sunday, 1st October, 1978. Full details will be in next month's notes. However, although the complete accommodation of a large motel has been reserved, it will be wise to advise the secretary WARC, PO Box 71, Kooringal (Wagga) 2650 as soon as possible.

Six students of the WARC novice licence course passed the May, 1978 P&T Department examination and six others gained passes in one or two subjects. The interesting point was that the students had completed only half the course, which was in preparation for the November, 1978 examination.

The WARC welcomes new members at their meetings on the last Friday of each month at the Wagga Rescue Club rooms.

EASTERN & MOUNTAIN DISTRICT RADIO CLUB: To qualify for the Southern Cross Award, sponsored by the club, Australian amateurs and SWLs have to gain 15 points. New Zealand amateurs and SWLs 10 points. All other amateurs and SWLs 5 points. A point is awarded for each club member worked — or heard, in the case of SWLs. The club station call signs VK3ER and VK3BNW each count two points but only three can be claimed if both are included in any one application for the award.

The award will be issued for multiband, multi-modes or specific bands and specific modes.

To obtain the award; a fee of 50 cents or 3IRC's together with a general certificate log should be sent to the Awards Manager, EMDRC, PO Box 87, Mitcham, Victoria 3132.

New Zealand amateurs and SWLs can forward their logs to Lester McMillan, 7 Duke Street, Leven, NZ.

The general certificate log rule means that any officer of a recognised amateur club or society, any two licensed amateurs or any Certificate Hunter Club member may certify that it is a copy of the applicants log. In this way original log or QSL cards do not have to be submitted.

Club nets are held each Wednesday night at 8.00 pm on 3.579MHz under the call sign VK3ER and on Sunday morning at 11.30 am on 28.480MHz with call sign VK3BNW.

BALLARAT AMATEUR RADIO GROUP: The Begonia Award certificate initiated by the group is available to amateurs or SWL's who can show confirmation of working or hearing Ballarat amateur stations.

As from 1st January, 1978 the requirements for the certificate are:

DX stations or SWLs — Work or hear 5 Ballarat amateur stations. Any band,

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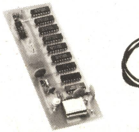

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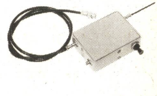

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any mode. Cost 8 IRC's.

VK stations or SWLs — Work or hear 10 Ballarat amateur stations. Any band, any mode. Cost $2.00.

Send list of stations worked or heard stating call sign, name, date, band, mode and time (GMT). Do not send QSL cards.

Send list to award manager, R. E. Barker, 22 Pauls Crescent, Wendouree, Victoria, Australia 3355.

Publicity officer for BARG is Brian Stares, VK3ZBS, 11 Malmesbury Street, Wendouree, Vic 3355.

MOORABBIN & DISTRICT RADIO CLUB: The club's social event for 1978 will be on Saturday, 4th November in the combined club rooms hall, Turner Road, Highett, Vic. A fine menu, a four piece band, lucky door and spot prizes will be highlights of the evening. The fee will be $10 per head and activities will be from 7.00 pm to 12.00 pm.

Contact Adrian Mensforth, VK3AAB telephone (03) 277 6648 for table bookings.

Club station VK3APC gained second place in the 1978 national field day.

GEELONG AMATEUR RADIO & TV CLUB: The club announces an award which should interest six metre operators. The award, called DXDC (DX decade club) is from the SMIRK organisation (Six Metre International Radio Club). It can be obtained by working 10 countries on six metres since 1st January, 1976. Membership of SMIRK can be obtained by Australian amateurs contacting three SMIRK members and obtaining their membership numbers.

Full details of SMIRK can be obtained by sending a self-addressed envelope and IRC to Ray Clark, K5ZMS, 7158 Stone Fence Drive, San Antonio, TX 78227, USA.

WIA WESTERN ZONE VICTORIA: The 1978 annual general meeting was held on Saturday, 27th May in the club rooms of the Horsham Amateur Radio Group.

Fourty-five zone members attended to elect a new council. Brian Stares, VK3ZBS, was elected president.

The general meeting that followed the AGM discussed such matters as the Western Zone boundaries which were redefined in terms of post code numbers.

The proposed TV channel 5A and its translators was discussed at length and a motion adopted that a suitable letter be drafted for amateurs in the area to sign and forward to commonwealth ministers.

Following the meeting, a ladies' night out with dinner was held at a restaurant in Horsham.

WESTERN AUSTRALIA VHF GROUP: Progress of the Wireless Hill Museum project. The steering committee now consists Mr Howson, Mayor of City of Melville as chairman; Miss E. Willes (WA Museum); Dr Pearson and Mr T. Honniball (Royal WA Historical Society); VHF Group members, Dr Wally Howse, VK6KZ, Jack Sullivan, VK6ZFO and Tom Berg, VK6ZAF.

The opening date is 14th October, 1979 as part of the WAY 79 celebrations. The display themes are: (a) Wireless Hill — Historical development. (b) Broadcasting — Radio and Television. (c) Flying Doctor Radio—Uniquely Australian Invention. (d) Military Radio—Development. (e) Amateur Radio. (f) Space Exploration. (g) Electronic/Communication Devices.

Mr J. O'Sullivan, VK6ZFO, has been appointed honorary curator of the Museum and Mr P. Green Armytage senior lecturer in design at WA Institute of Technology as display consultant.

The WA VHF group, in addition to collecting further items for display, has encouraged the formation of an informal sub-group of members but including others interested in the museum project.

AMATEUR STATION FOR SYDNEY SCIENCE MUSEUM

The Museum of Applied Arts and Sciences, in Sydney, will shortly be heard on the amateur bands. An amateur station, featuring both HF and VHF facilities, has been donated to the museum by Dick Smith Electronics Pty Ltd, together with aerials, coax cables, etc. It will be on show to the public in the musuem's building in Harris St, Ultimo, only a short distance from Sydney's central railway station.

The station will be manned by volunteer amateur operators and the installation will be supported by a display showing the evolution of amateur radio in Australia, and its contribution to present day society.

The museum would be happy to inspect items of historical value that may be loaned or donated. Anyone interested is asked to contact Mr J. Sergel at the Museum or on phone (02) 211 3911.

IONOSPHERIC PREDICTIONS FOR AUGUST

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open.

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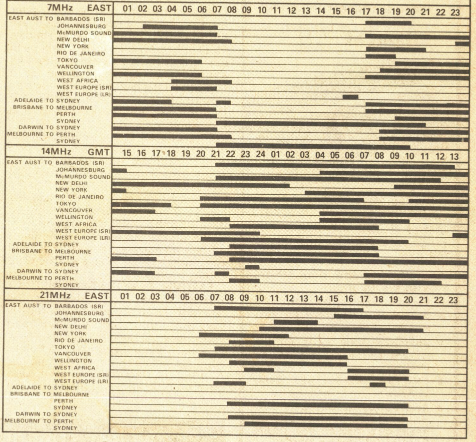


SO YOU WANT TO BE A RADIO AMATEUR?

To achieve this aim, why not undertake one of the Courses conducted by the Wireless Institute of Australia? Established in 1910 to further the interests of Amateur Radio, the Institute is well qualified to assist you to your goal. Correspondence Courses are available at any time. Personal classes commence in February each year.

For further information write to

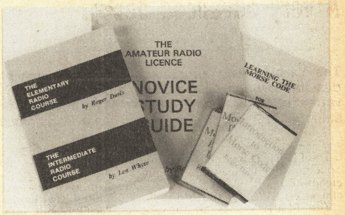
THE COURSE SUPERVISOR, W.I.A.

14 ATCHISON STREET,
CROWS NEST, N.S.W. 2065

AMATEUR RADIO

Novice study package covers theory and code

NOVICE AMATEUR RADIO LICENCE STUDY PACKAGE by Roger Davis and Len Whyte, published by Ann Davis Publications. This package consists of; THE NOVICE STUDY GUIDE, THE ELEMENTARY RADIO COURSE, THE INTERMEDIATE RADIO COURSE, LEARNING THE MORSE CODE, and three tape cassettes, INTRODUCTION TO MORSE CODE, and two MORSE PRACTICE LESSONS.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by Roger Davis
THE INTERMEDIATE RADIO COURSE
by Len Whyte
THE AMATEUR RADIO LICENCE
NOVICE STUDY GUIDE
LEARNING THE MORSE CODE

THE NOVICE STUDY GUIDE by Roger Davis. Soft covers, 72 pages 200mm x 260mm of duplicated material with stapled binding. Mostly text, with a few block diagrams and circuits. Price $2.40 plus 60c postage. (A professionally printed and bound version is in preparation.)

While basically a study guide, this does contain some technical text. It starts with exam application details, such as autographed photograph, birth certificate, where to apply etc.

The next 10 pages constitute a derived syllabus, intended for both instructor and student. It details the subjects which need to be covered and discusses the depth of study required.

The study guide proper, which follows, is intended to be used with the "Elementary Radio Course" and "Intermediate Radio Course" in the companion volume.

It is divided into 24 "units", as the basis for 24 lessons or classes. Most units consist of questions appropriate to specified chapters in the companion volume, and which are designed reveal to the student how much he has — or hasn't — learnt. A few, as already mentioned, consist of both text and questions. The answers to the more difficult questions are given at the back of the book.

Finally there is a set of "sample questions" in the style of a conventional exam, consisting of 50 theory questions and 30 regulation questions.

THE ELEMENTARY RADIO COURSE by Roger Davis, and THE INTERMEDIATE RADIO COURSE by Len Whyte. One volume, 201 pages, 150mm x 230mm, soft covers, many circuits and diagrams. Price, $4.80, plus 60c postage.

The Elementary Radio Course occupies the first 43 pages of this volume and consists of a mixture of theory and simple practical projects. In fact it starts by describing how to build a crystal set.

There are several other practical projects and exercises designed to demonstrate such basic principles as magnetism, induction, current flow, etc, as well as another crystal set and one transistor set. These are interspersed with chapters ranging from the structure of matter to the philosophy of fault finding.

These subjects are well presented, but I feel bound to criticise the drawings. Most are freehand, and below the standard expected in a professional publication.

The remaining 158 pages are occupied by The Intermediate Radio Course. This is a much more detailed study which provides a logical continuation and expansion of the Elementary Course.

It deals with many subjects in greater depth than is strictly necessary for amateur licence study, and this is where the study guide will prove invaluable. In cass this creates the impression of a "heavy" approach, we would emphasise that this is not the case.

The writer has adopted an easy style, and attempts to explain each subject in a "commonsense fashion" (to use his own words). This is not always easy, but he appears to have done a good job.

And, happily, the drawings in this section are of a higher standard, though suffering from over-reduction in a few cases.

To sum up the package thus far: A bit rough in patches, but technically accurate and comprehensive. It should provide an excellent starting point for any prospective amateur, with the advantage that it is geared to the Australian scene.

LEARNING THE MORSE CODE by Roger Davis. A 16 page booklet, 140mm x 215mm. INTRODUCTION TO MORSE CODE (C90 cassette) and MORSE PRACTICE LESSONS (2 x C60 cassettes). Total cost, $10.50.

The booklet gives the bakground to Morse code, describes the author's "sound only" method of teaching, plus general advice on how to study and how to approach the examination. The "sound only" method consists of presenting the letters directly in their sound form, shunning any attempt to learn them from the printed page.

The tape presents the alphabet divided into four groups, with each letter presented in spoken form (di-dah) and as keyed on an oscillator, with the letter being identified AFTER the sound.

When the student has mastered each group he moves on the next one, but continues to study the previous groups. The whole of side "A" is devoted to letters only. (Incidentally, although the booklet refers to sides "A" and "B", the cassettes were not so identified. In addition, side "B" of cassette two commenced with a repeat of the introduction on side "A".)

Side "B" deals with figures, punctuation marks, start and finish signs etc, followed by exercises involving all the letters, figures etc presented to that point. Cassettes two and three are practice tapes.

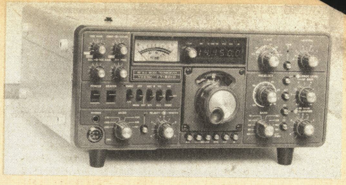
While it is impossible to fully evaluate any code teaching system unless one has actually used it, starting from scratch, this system does appeal as being completely logical and well presented, requiring only application on the part of the student to make it a success.

To sum up: As with the text books, there are a few rough edges which need to be smoothed out, but these are minor and do not effect the accuracy or effectiveness of the course as such.

The whole package — Morse course and theory — should provide the prospective amateur with most, if not all, the information and guidance he needs to reach the novice standard. It is also good value for money. While individual items are available at the prices quoted, the complete package is being offered for $18.00 posted to anywhere in Australia, even where postage may be well over $2.00. (PGW)

AMATEUR RADIO

YAESU FT901 transceiver: A very advanced design



The Yaesu FT901 series transceiver is a unit of very advanced design, covering all the HF amateur bands, and available with a variety of fitments and options. While intended primarily for base station operation, it nevertheless has the potential for mobile work.

The FT901D is the basic unit and the optional fitments featured are: Curtis electronic keyer; Memory unit; DC-DC converter; CW filter and AM filter.

The FT901DM has all the above accessories built in, with the exception of the CW and AM filters.

Both versions are rated at 100 watt power output (or 180W PEP input), the transmission modes available being USB; LSB; CW; FSK; AM and FM.

Overall dimensions — 342mm(w), 154mm(h), 324mm(d). Weight 18kg.

The power amplifier uses a pair of 6146B's driven by a 12BY7. Solid state techniques are used in all other sections, with 375 semiconductor devices noted in the manual.

Hand press-to-talk microphone, power cord and plugs to fit various accessory sockets are supplied with the transceiver, together with a 64-page instruction manual. This sets out the tuning procedure and offers a brief functional description illustrated by a circuit diagram and photographs of the various circuit boards and assemblies.

The unit is well engineered and solidly constructed. The front panel is eye catching, reminding one at first glance of an aircraft cockpit layout. There are 38 separate controls (knobs and switches) an analog dial, digital readout, multi purpose meter, microphone socket, headphone outlet and 11 LED indicators on the panel.

In addition, the rear panel offers no less than 19 sockets providing for antenna, Morse key, external VFO, FSK)170Hz shift), transverters etc. Provision is also made for access to VOX controls and 25/100kHz crystal calibrator switch through a small removable panel on the top cover.

The transceiver initially used for this review as a basic FT901D; later a similar unit fitted with the memory unit was checked.

On-air tests were carried out over 12 days during different periods of the day and evening and varying propagation conditions. All bands except 1.8MHz were used, the modes being SSB, AM, FM, FSK(receive) and CW.

The results left little to be desired. Contacts made included Europe, United Kingdom, USA, New Zealand, Pacific Islands, interstate and local call areas. All reports on signals transmitted were readible 5 even at low signal strength reports. Without exception, reports on SSB, AM and FM transmissions remarked on the excellent quality of the audio and absence of adjacent frequency splatter. Going on the reports, speech processor did not adversely affect audio quality.

The performance of the receiver was considered to be well up to specifications stated, with the reject-width IF filter controls proving smooth in operation and adequate in dealing with interference encountered in all modes. The audio peak frequency (APF) control gave an extremely high degree of filtering for CW signals.

The VFO is a modified Colpitts type oscillator, which generates a 5.0-5.5MHz signal. Separate crystal oscillators for each band produce a heterodyne signal for the phase locked loop (PLL) mixer. A voltage controlled oscillator (VCO) 8.9975kHz higher than the operating frequency generates the heterodyne signal.

Frequency stability was found to be excellent and, although no laboratory type checks were made, it was equal to all requirements for amateur communication.

The frequency readout is designed to indicate carrier frequency and there will be a 3kHz difference between USB and LSB. To ensure accurate frequency calibration of dial and digital display it is desirable to check each band and mode in accordance with the instruction manual. Ultimate accuracy will be dependent on the operator's ability to recognise the exact zero beat point with the 25/100kHz marker signal when checking the calibration. There are separate adjustments for the analog dial and the digital readout. A WWV receive facility is also available.

Other features of the FT901D include a 10 second timer to protect the PA tubes during tune up procedure, which should be done in accordance with the instruction manual. There is a microphone gain threshold control, available to inhibit triggering on noise ambient with VOX operation. Noise blanker, FM squelch control, RF attenuator, clarifier, monitor facility for speech and CW sidetone all adequately serve their respective roles.

The memory unit is a useful device in several ways, but split frequency operation, net control or contest operation seem to be its main use. Cross band operation is not possible, due to the necessity to retune for each band. Individual operators will devise their own procedures. The memory unit is optional fitment available for the FT901D.

Some points, which in no way affect performance, did nevertheless jar somewhat at first encounter: The dial is rotated anti-clockwise to tune higher in frequency; all other controls relevant to frequency change are clockwise oriented. Although not so marked, the digital display reads frequency in MHz; other related controls refer to bands as 160, 80, 40, 20, 15, 10; the band switch control even shows segments 10A; 10B; 10C; 10D. It would be more uniform if the bands were shown in MHz i.e. lower band edge frequency 1.8 to 29.5. Also if MHz, kHz and Hz were shown under the appropriate sections of the frequency readout display.

SUMMING UP:

To sum up, the Yaesu FT901D may well be considered by some as over-developed — and therefore over-priced — for routine amateur band "nattering". It is, indeed, a complex piece of equipment.

On the other hand, it must have a strong appeal to the amateur who is a specialist or who simply aspires to all the refinement that modern solid-state technology can provide. To such prospective buyers it would offer an impressive array of facilities, plus the proved performance of vacuum tubes in the high power RF stages.

The units reviewed were supplied by Dick Smith Electronics. Their price tag on the FT901D is $1275, with $149.50 extra for the memory unit and $75 extra for the DC/DC inverter. (PJH-VK2APQ)

ICK SMITH for AMATEURS

Dick has an enormous range of amateur equipment, and it's growing daily! Call in today and have a look around. You're under no obligation! Dick Smith Electronics – the professional amateur suppliers.

New FULLY LEGAL ANTENNA ROTATOR

Handles most beams with ease. Supplied with fully approved power supply (Cat. M-9560) and large, easy-to-read control box.

- * Massive disc brake
- * Fits up to 2" o.d. mast
- * Rugged construction
- * Completely waterproof
- * Suitable for Wilson System

COMPLETE UNIT – Rotator, control unit and approved power supply:

$148.00

Rotator & control box without power supply: Cat D-5000 .. . $122.00

Additional mast clamps (if required): Cat D-5001 .. .. . $12.50

WE BELIEVE THIS IS THE ONLY APPROVED ROTATOR IN ITS CLASS IN AUSTRALIA!

BARGAIN ROTATOR CABLE: 4 core cable for only 35c/metre. Sure, you'll need two lengths – but you get the equivalent of an 8-core cable. Parallel wires to the motor for minimum voltage drop – or use spare wires to control antenna changeover relays! Ideally suited to above rotator. **Cat. W-2040** **35c/metre**

INCREDIBLE BARGAINS!

MULTI Q-16 2m TRANSCEIVER

2 special priority positions to monitor your favourite cahnnels * Large 23 ch. capacity * Provision for external VFO

~~228~~

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Cat D-3009

Some xtals available for only $4.75 pr. Check at a store!

XXXX SPECIAL APOLLO LINEAR

was $299.50 now $199.50

$100 OFF

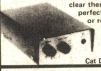
- * Full 200W SSB *40–10M
- * In-built RF pre-amp
- * Only 3Wdrive
- * RF actuated – no messy control wires!

Cat D-2544

Originally $229.50 Save $100 !
NOW REDUCED TO ONLY $199.50
Don't miss out – Stock strictly limited.

BELOW COST!

FK-2 IC keyer was $82, now $32.00! Way below cost to clear them out. They work perfectly, but no g'tee or return at this price!



$32

Cat D-7102

No-hands mobile

Safety and ease of operation for all mobilers. Headset mic/earpiece suits most rigs – 600 ohm mic, 8 ohm 'phone. Wire to suit your rig (plug extra).

Cat C-1120

$27.50

FOR MORSE CODERS:

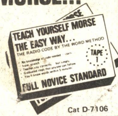
Economy Key

Yes, that's the right price. Only $1.80 for a bargain key that's ideal as a first key. Excellent value for money, Cat D-7105

$1.80

LEARN MORSE...

Here's value: two cassettes recorded with easy-to-learn Morse. Starts off simple, goes to full novice standard. Completely aural course – no printed matter to slow you down! **$7.90**



TEACH YOURSELF MORSE THE EASY WAY...
THE RADIO CODE BY THE WORD METHOD
TAPE 1
FULL NOVICE STANDARD

Cat D-7106

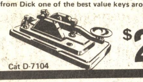
Quality budget key

New magnificent precision built key. Pro quality – hours of relaxed operation; Introductory price: Cat D-7101

$14.75

Hi-Mound deluxe

When you want a REAL morse key, here's the Hi–Mound. It's probably one of the best hand keys on the market – and at the budget price from Dick one of the best value keys around.



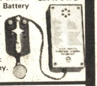
$25.00

Cat D-7104

Morse trainer

Kit contains all parts to build this practice oscillator. Battery operated, ideal project. Cat K-3472

$5.90 Key Extra.

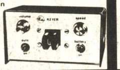


BUILT-UP VERSION: As pictured, but no key. Cat D-7110 .. .. $7.90

KEYER KIT $37.50

Complete kit inc. paddle. Case is undrilled, plain panels See E.A. March '78. Cat K-3470.

PADDLE only: Cat D-7103 .. .. $17.50



Banish TVI FOREVER!

The ULTIMATE in low-pass filters!

Precision built, 4 section filter. Massive power rating – 5000W PEP on SSB. Maximum attenuation is on TV channel 2 – 75dB. Insertion loss is less than 0.5 dB, has SO-239 connectors. 52 ohms.

WHY TAKE CHANCES?

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$37.50

New! Wilson HF antennas

SYSTEM ONE BEAM

- * 5 element
- * 10dB gain!
- * 8m boom
- * 8m longest element
- * 5.6m turning radius

$425 Cat D-4330

SYSTEM TWO BEAM

- * 4 element
- * 8.5dB gain
- * 5.6m boom
- * 8m longest element
- * 5m turning radius

$320 Cat D-4332

BOTH ANTENNAS 50 OHMS IMPEDANCE, SWR LESS THAN 1.5:1
HUGE POWER RATING – KILOWATT PLUS . . .
Maximum strength and minimum wind resistance

Optional recommended toroidal balun for either system: Cat D-4334 .. $19.95

NEW! Tetra tower sections

Dick Smith really is the complete amateur store: Now you can even buy your tower from us!

Cat D-4336 $59.50 PER SECTION

Introducing: the Wilson Tetra Tower system: You can buy one section at a time, or you can buy a complete mast. Each section is 3.5 metres long when assembled, yet is supplied in a carton only 1 metre long. No need to hire a truck!

You can assemble as many 3.5m sections as you like – 4 give you a 14m mast, (45'4") etc etc. Accepts a 2" o.d. mast at top. Extremely strong (will support the system one at 68 ft suitably guyed)

It's the painless way to buy a world-class tower.

Tower top & rotor plate option: Cat D-4338 .. .. .. $29.50

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DICK SMITH ELECTRONICS

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YAESU from DICK SMITH

WHEN YOU REALLY CONSIDER THE ALTERNATIVES – THERE ARE NONE!

Fabulous FRG-7 Communications Receiver

- 0.5 to 30MHz continuous reception
- Wadley loop circuitry for stability
- Mains or 12 volt operation – portable.
- BFO for sideband or CW reception
- 0.7uV sensitivity (for 10dB signal/noise)
- 2 IC's, 22 transistors and 16 diodes
- Comes with full instructions plus guide

EXCLUSIVE!
With every FRG-7 from Dick Smith or dealers, you receive this exclusive 6 page guide to short wave listening – written by Arthur Cushen, MBE – world famous short-wave correspondent and broadcaster.

only $350

Terms available

CAT. D-2850

See the review in MAY 1978 E.A.

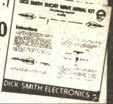
★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★

NOW: A short wave antenna kit for the FRG-7 receiver (and any other shortwave receiver . . .)

Designed specifically for Dick by a short-wave expert, this antenna kit needs no soldering, is complete and ready to assemble and has full instructions. Get the most out of your receiver with a good antenna.

$9.50

VALUE! Cat K-3490



EASY TERMS AVAILABLE TO APPROVED APPLICANTS

THE INCREDIBLE FT101E.... WORLD'S TOP TOP SELLING HF TRANSCEIVER –

Why settle for less ?

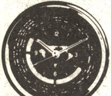
The *complete* 160M-10M HF amateur radio – just add antenna and either 240V or 12V (yes, it has an inbuilt DC–DC converter!). Rated at 260W PEP and the in-built RF speech processor makes it sound even better.
These units are so popular, we probably don't have to tell you about all their fabulous features – but call into D. S. store and we'll be happy to anyway!
Cat D-2860 . . . . $895.00

Impartial tests * prove the FT-101E receiver section is far superior to the TS-520S:

Minimum detectable level:	FT-101E 8dB MORE SENSITIVE
Intermodulation distortion:	FT-101E 4dB BETTER
Dynamic range:	FT-101E 12dB BETTER

(* QST May 1978 comparison)

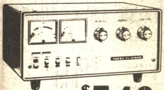
WHY NOT BUILD YOUR WHOLE STATION AROUND THE FABULOUS FT-101E?



(Left) The QTR24 world clock. Work out at a glance what the time is in all time zones. Every ham should have one.
Cat X-1054 .. .. $33.00

(Right) YD-844A desk microphone. 500 ohm/50k switch makes this ideal for all Yaesu transceivers. Complete YOUR base station with a Yaesu microphone.
Cat C-1116 .. .. $44.50

HOW'S THIS FOR THE ULTIMATE STATION?



FL-2100B HF LINEAR AMP $540

Time proven reliability! The 2100B is world famous for it's GUTS! 1.2kW of muscle – the ideal match for the FT-901D or the FT-101E. Best value linear amp available today!
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Easy terms available on all Yaesu transceivers to approved applicants. Ask at your store!

Cat D-2854

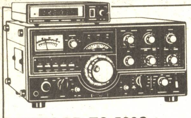
FT-901 D – ALL MODE ALL HF BAND TRANSCEIVER $1275

Tomorrow's transceiver today . . . All mode operation – yes, even FM! This beautiful Yaesu has to be seen (and heard) to be believed. It's got features others just dream of!
Basic unit: $1275 . . . Add the optional memory unit (Cat D-2858 @ $149.50) and the DC-DC converter (Cat D-2856 @ $75.00) and still pay less than $1500.00 . . .
The acc plug features switchable 12V coupled to the band switch., Use our co-ax relay (Cat D-5210) to automatically switch antennas. WHY PAY MORE?

FTV-250 – 2 M TRANSVERTER $329

FULL 2M operation when used with the FT-901D. SSB & CW for DX & OSCAR enthusiasts – FM for local work . . .
Covers 144 to 148MHz, all solid state.
Also suits the fabulous FT-101E
Why miss out on some of the hard-won bands. Remember: use them or lose them!
Cat. D-2894

All rigs pre-delivery checked!



KENWOOD TS-520S SSB transceiver

TS-520S features: • 160 thru 10 meter coverage • Optional DG-5 frequency display (on top of unit) • New speech processor with audio compression amplifier • Built-in AC power supply (DC-DC converter, optional) • RF attenuator

789.00

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SM220 station monitor	$335.00
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DS-1A dc/dc converter for TS820S/TS520S	$79.00
TS520S HF transceiver 160-10m	$789.00
VFO520S matching VFO for TS520S transceiver	$155.00
SP520 matching speaker for TS520S	$39.90
DG-5 digital display for TS520 series	$206.00
TV506 6m transverter	$236.00
TV502 2m transverter	$245.00
TV502S 2m transverter	$290.00
TS700SP 2m all-mode transceiver	$899.00
VOX-3 VOX unit for TS700 series	$25.00
TR3200 70cm fm portable transceiver	$229.00
TR7400A 2m digital mobile fm transceiver	$499.00
TR7500 2m synthesised fm transceiver	$399.00
R-300 general coverage communications receiver	$260.00
MC-50 desk microphone	$58.00
MC-35S ptt hand mic, high Z	$20.00
HC-2 Ham world clock	$34.00
TL922 HF linear amplifier	POA

ICOM

IC701 HF solid-state 160-10m transceiver	$1180.00
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IC202E 2m ssb portable transceiver, 3 watts	$219.00
IC502 6m ssb portable transceiver, 3 watts	$219.00
IC22S 2m fm synthesised mobile transceiver	$299.00
IC211 2m all-mode ac/dc transceiver	$785.00
IC245 2m fm digital mobile transceiver	$465.00
– ssb adapter for above	$142.00
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ICSM2 condenser electret microphone (base)	$56.00
IC50L 6m 10w linear amplifier	$98.00

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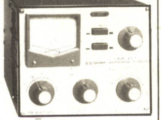
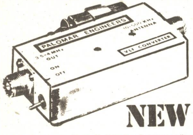
	MODEL **CNW-217**	MODEL **CNW-417**
Freq coverage	1.8 thru 30MHz	1.8 thru 30MHz
Input power	100w CW, 200w pep	200w Cw, 500w pep
Input impedance	50 ohms unbalanced	50 ohms unbalanced
Output impedance	10-300 ohm unbalanced	10-300 ohms unbalanced
Price	**$179.00**	**$219.00**

NEW

DAWA



VLF CONVERTER



- New device opens up the world of Very Low Frequency radio.
- Gives reception of the 1750 meter band at 160-190 KHz where transmitters of one watt power can be operated without FCC license.
- Also covers the navigation radiobeacon band, standard frequency broadcasts, ship-to-shore communications, and the European low frequency broadcast band.

The converter moves all these signals to the 80 meter amateur band where they can be tuned in on an ordinary shortwave receiver.

The converter is simple to use and has no tuning adjustments. Tuning of VLF signals is done entirely by the receiver which picks up 10 KHz signals at 3510 KHz, 100 KHZ signals at 3600 KHz, 500 KHz signals at 4000 KHz.

The VLF converter has crystal control for accurate frequency conversion, a low noise rf amplifier for high sensitivity, and a multipole filter to cut broadcast and 80 meter interference.

All this performance is packed into a small 3'' x 1½'' x 6'' die cast aluminum case with UHF (SO-239) connectors.

The unique Palomar Engineers circuit eliminates the complex bandswitching and tuning adjustments usually found in VLF converters. Free descriptive brochure sent on request.

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NAGARA V4Jr 40-10m, 5.2m high, no guys	$99.00
NAGARA V5Jr 80-10m, 6.7m high, no guys	$139.00

TRAP DIPOLES

RAK Midy VN 80-10m trap horizontal, 23m long	$103.00
RAK AL48DXN 40/80m trap dipole	$62.00

JAYBEAM ANTENNAS

88/70 88 el for 70cm, 18.5dBd gain	$99.00
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PBM18/70 18 el, 70cm, 14.9dBd gain	$69.00
D8/70cm twin 8 el for 70cm, 12.3dBd gain	$59.00
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GDX-1 80-480MHz commercial discone	$79.00

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Daiwa PBA-1200 70cm and 1.2GHz, complete	$249.00

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M22T	¼ wave 2m mobile whip, top only	$7.00
M25	5/8 wave 2m mobile whip, top only	$17.50
–	base for above	$4.00

VALVES

6JS6C	for FT101 series	$12.00
6146B	for Kenwood, Uniden	$13.00
6KD6	for early Yaesu linears	$13.00
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SHORTWAVE SCENE

by Arthur Cushen, MBE

Expansion of short-wave bands predicted at WARC '79

In September next year, the World Administrative Radio Conference will be held in Geneva. At this meeting, it is expected that the international short-wave bands will be expanded to double their present frequency ranges.

At the present time, around 2400kHz is set aside for international broadcasting in the bands ranging from 6-25MHz. Two-thirds of this is in the range 6-17MHz, which is by far the most useful band for the international short-wave stations. The 21 and 25MHz bands are used mainly during periods of high sun-spot activity.

It is expected that over 140 countries will attend the conference in Geneva as against 90 attending 20 years ago, and an indication of the interest many countries have in international broadcasting can be gauged from these figures.

The BBC recently made known their plans for the expansion of the short-wave bands, while a conference held last year between 14 of the major European broadcasters came up with a similar pattern of expansion. It seems that the international bands will be doubled in size and a new band created around 13MHz.

As far as the short-wave listener is concerned, the most disturbing news is the announcement that the present 60-metre band (5MHz band) could be used for international broadcasting. This band, between 4750 and 5060kHz, is widely used for broadcasts throughout Africa, Asia and Latin America and is one of the main areas of low frequency reception which short-wave listeners enjoy. The use of unlimited high-powered transmitters on this band would result in chaos. The idea has recently been squashed by non-aligned countries (at a meeting in Algiers) who are not in favour of the 60-metre band being allocated to international broadcasters.

The following international short-wave bands are proposed: 3900-4060, 4750-4995, 5005-5060, 5740-6200, 7100-7500, 9400-9900, 11500-12025, 13600-14000, 15100-15700, 17500-17900 and 21450-21850kHz. Only the 11 metre band would remain unchanged.

From the DXers point of view, the main points are the proposed elimination of amateurs from the 41 and 75-metre bands, the introduction of a new 22-metre band, and the allocation of international broadcasting to the 60-metre band.

Readers should also be aware that on November 23, stations throughout the world, except in the Americas, will adopt a new plan for medium-wave broadcasting in which stations will be separated by 9kHz instead of 10kHz as at present. This will make 120 frequencies available on the medium-wave band.

TESTS FROM UGANDA

Radio Uganda has been heard testing to Eastern Europe on 9730kHz from 0410GMT. The station was heard playing recorded English pop music with an announcement after each third record. The announcement confirmed that the test transmission was to Eastern Europe and that reports from listeners should be sent to: Chief Engineer, Uganda Broadcasting Corporation, PO Box 2038, Kampala, Uganda. There was severe sideband interference from Duetsche Welle on 9735kHz during our reception.

The World Radio Handbook Newsletter reports that the present schedule of Radio Uganda is: Home Service relays on 6030kHz at 0900-1100, 1300-1415, and 1700-1730GMT; to East and Central Africa 1415-1600 on 6030 (1415 Swahili 1500 English, 1530 French); and to South Africa 1608-1650 (English) and 1740-1755GMT (Shona) on 9515kHz.

Further tests from Radio Uganda have been noted on 15325kHz when the transmissions are directed to North America. The broadcast was observed between 0300-0400GMT, and announcements were given in English and French requesting reception reports, as was the case in the test transmission to Eastern Europe. (This information, from the "New Zealand DX Times", was reported by John Mainland and Bryan Clark of Wellington.)

RADIO AFGHANISTAN

The recent coup in Afghanistan has resulted in that country's radio service reverting to the name of "Radio Afghanistan" instead of "Ariana Afghan National Radio and Television". The broadcasts from Kabul have been heard on 4775kHz with English at 1300GMT. The program mainly consists of political talks with some popular music up to 1330GMT.

Radio Afghanistan is using 11820kHz for the broadcast to Europe and has been heard with English at 1900-1930GMT. The BBC Monitoring Service reports that, following requests from listeners in Europe, the transmission from 1000-1300GMT has been moved to the new time of 1630GMT. The languages used are Arabic 1630-1700; Russian 17001730; Pushtu 1730-1800; Dari 1800-1830; German 1830-1900; and English 1900-1930GMT.

US GOSPEL STATIONS

There are three gospel stations broadcasting on short-wave from the United States: WYFR, WINB and KGEI. WINB uses only one transmitter and its schedule is not subject to variation, but the other two broadcasters make frequent changes to their operating schedule.

Station KGEI in San Francisco, California, is now using three frequencies in the 31-metre band and these have been heard during our evening listening period. A broadcast in Russian has been noted on 9530kHz at 1200GMT, while Japanese is broadcast at 0800GMT and Russian at 0900GMT on 9555kHz. At 1000GMT a further frequency change is made to 9580kHz for an English transmission, and at 1100GMT the program is in Chinese.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

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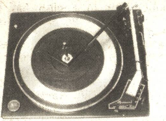

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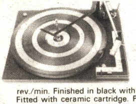

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SHORTWAVE SCENE

Station WYFR, with studios in Oakland, California and transmitters at Okeechobee, Florida and Scituate, Massachusetts, has been heard on several new frequencies. Broadcasts on 5985kHz are noted to closing at 0500GMT, while on 21525kHz an English program is heard up to 2100GMT.

LATIN AMERICAN SIGNALS

The past winter has again provided interesting signals from Latin America around 0400 onwards, and again from 1000GMT.

COLOMBIA: La Voz de Maria Radio Kennedy, operating on 4775kHz, has been heard at our listening post south of Invercargill, closing at 0400GMT after a Catholic religious service.

"La Voz del Llano" has been received on 6115kHz at 1000GMT by Harry Weatherley of Melbourne. Following station identification in Spanish, the sound of dog barks and other farm noises were heard as the broadcast opened. Doug Berndt of Queensland, reporting in "DX Post," states that this frequency is generally well received in his area, with Radio Union from Lima being the dominant station.

ECUADOR: La Voz de las Caras on 4795kHz has been tuned after 0400GMT when the Bolivian station on the frequency closes. The signal from Ecuador was received in our location up to 0520GMT.

PERU: Radio Atlantida has been heard by Brian Dodgson of Melbourne on 4790kHz. This station closes at 0600GMT. Radio America in Lima has been received by Robert Yeo in Melbourne at 0855GMT on 9595kHz, according to "ADXN".

DOMINICAN REPUBLIC: Radio Television Dominican has been heard on 5970kHz. Peter Bunn, reporting in "ADXN" states that the signal was heard at 1030GMT, with news in Spanish at 1100GMT. In New Zealand, this transmission has been logged during the afternoons, with best reception around 0430GMT.

SOFIA'S NEW OUTLETS

Radio Sofia, Bulgaria, is using several new frequencies for its English broadcasts and one of these is 11750kHz. This frequency has been used by the BBC since 1932, when it was registered as GSD. Transmissions from London are thus blocked during two periods by the signals from Bulgaria. As well, during our afternoons Radio Pakistan has also been noted on the 11750kHz.

The new schedule for broadcasts in English from Radio Sofia includes a broadcast to the British Isles 1930-2000GMT on 9700 and 11720kHz; and 2130-2200 on 11750 and 15125kHz. Broadcasts to North America are 0000-0100 on 15330kHz and 0430-0500GMT on 11750kHz.

RADIO STENTOR

The new Bolivian station, Radio Stentor at La Paz, was first noted on 6125. Recently, however, John Campbell of Newcastle, NSW, while listening near Invercargill, heard them on the new channel of 6173kHz. In the opening announcement at 1100GMT, Radio Stentor gave its frequencies and said that its transmitter was built in Bolivia. This could be the cause of the unstable reception.

Swedish listeners have reported the frequency as high as 6183kHz when heard around 0300GMT.

The frequency of 6173kHz suffers some interference from the Philippine Broadcasting System on 6170kHz. Peter Bunn of Melbourne reports that Radio Nacional in Caracas, also on 6170kHz, opens at 1000GMT and could also cause interference to Radio Stentor.

Cleyton Howard, host of HCJB DX Party Line broadcast from Quito, Ecuador to Australia and New Zealand. Transmission times are at 0900GMT on Monday, Thursday and Saturday on 6130, 9745 and 11900kHz.

BUCHAREST SERVICE

Radio Bucharest in Romania is heard well during our afternoons for its English transmission to North America. Several new frequencies have been noted in the broadcast 0400-0430GMT. Two of these channels are 11705 and 11840kHz and the former provides good reception. Reception on the latter frequency is poor. Other frequencies in use at this time are 5990, 6155, 9570, 9690, 11705, 11840 and 11940kHz.

NIGERIAN REGIONAL SERVICE

The Nigerian Broadcasting Corporation regional station at Jos has been noted opening at 0430GMT on 5965kHz. The program is in English and the frequency is given as 5.9 short-wave during the opening announcement.

At 0445GMT, Trans World Radio at Monte Carlo commences transmission in German and blocks the frequency to 0515GMT.

LISTENING BRIEFS
EUROPE

DENMARK: Copenhagen has been heard on 9710kHz at 2055GMT with their interval signal. According to John Mainland of Wellington, NZ a station announcement in English has been heard at 2108GMT and then follows a program in Danish.

FINLAND: Helsinki has been observed on some new frequencies and their transmission to Australia and New Zealand is now carried on 17840kHz 0930-1000GMT. This transmission, in English, replaces the old frequency of 17785kHz. A broadcast in English to North America on 11800kHz is giving good reception 2300-2330GMT, while the same program is available on 15265kHz. English to the United Kingdom 2130-2200GMT has been observed on 15270kHz.

SWEDEN: Radio Sweden has vacated 11800kHz (now used by Finland) and is using 15205kHz at 2300GMT for the broadcasts to North America. In this area, the frequency is blocked by Radio Australia.

ASIA

GUAM: KTWR, Agana continues to be received on new frequencies. The early evening broadcast is now on 11780kHz from 0900GMT. At 1100GMT, the station leaves 11780kHz and moves to 11775kHz. At the same time, 17855kHz comes into operation. The frequency of 11775kHz is used after All India Radio closes.

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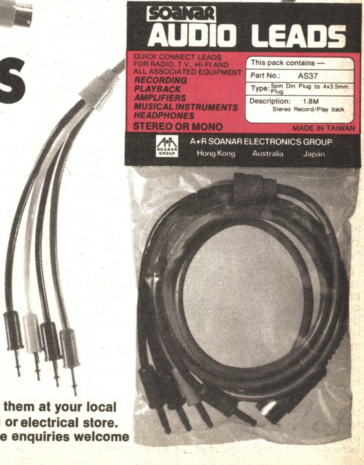

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New Products

Stereo & mono microphones from Technics

A new line of Technics microphones has been introduced recently to the Australian market. Using the electret principle, they combine good appearance and good performance with a modest price structure, giving them an instant appeal to the enthusiast market, as well as to professional users.

On display: the new range of Technics electret microphones. The RP-3210E on the left is a single unit stereo mic containing two electret capsules.

The modern electret microphone is an adaption of the time-honoured capacitor or condenser microphone, which was widely used in professional circles, but which required the provision of a large polarising voltage and an outboard preamplifier.

In an electret microphone, the diaphragm — a high polymer plastic film — is given a permanent charge by exposure to a strong electrostatic field, thereby obviating the need for a high DC polarising voltage. Furthermore, with modern technology, the preamplifier, complete with its 1.5 or 3V supply, can be built right into the microphone assembly. As a result, the electret microphone becomes a self-contained unit with an output voltage high enough, and an output impedance low enough, to work straight into practical lengths of ordinary shielded microphone cable.

The one distinguishing feature of an electret mic. is a switch to turn off the the preamplifier when the microphone is not in use. Even so, the drain is so low that there is no great penalty for forgetting to do so. More important is the usual instruction to remove the battery when the microphone is being stored away, to minimise the risk of the cell rupturing and causing corrosion.

The special nature of the diaphragm and the very simple preamplifier impose some limitations on the ultimate performance of electret microphones but they are nevertheless well up to the needs of quality speech, public address and advanced home recording. And they are fully competitive with dynamic microphones in the equivalent price range.

The Technics RP-3210E, on the left of the group pictured, contains two electret units and two preamplifiers, being intended primarily for use with stereo recorders or stereo amplifier systems. The polar diagram, as published, indicates that the individual units are not highly directional but, being set 160 degrees apart, they give good sensitivity respectively to the left and right, with ample frontal overlap.

Frequency response is quoted as 50-12000Hz, although it must be added that the curve shows a progressive taper through —3dB at 200Hz, —10dB at 100Hz, and —16dB at 50Hz. Output impedance is quoted as 600 ohms and sensitivity —70dB (0dB = 1V/ubar at 1kHz).

The RP 3210E comes complete with mic. holder, a fold-up desk stand, ⅜in adaptor, and 3m of cable terminating in twin jack plugs. Recommended retail price is $45.00.

Second from the left is the RP-3540E, a unidirectional mono mic with LED battery indicator. Its rated response is somewhat wider at 40-14000Hz, the bass response being level at 200Hz and tapering through -8dB at 100Hz and -12dB at 50Hz. Output impedance is 600 ohms and sensitivity the same as for the stereo mic at -70dB. Inherent noise is quoted as 30dcB, wind noise at 45dB and maximum sound pressure level at 120dB. Fitted with 5m of cable, and with folding desk stand, the recommended retail price is $50.00.

Third from the left is the RP-3500E, suggested by the manufacturers for close-up work. Fitted with a somewhat more elaborate windshield, it has a wind noise rating of 48dB and a maximum sound pressure level of 122dB. The directivity pattern and frequency response curves are very similar to those for the RP-3540E, but the sensitivity is marginally higher at —68dB. Recommended retail price is $45.00.

On the right of the group is the RP-3330, which sells for a modest $25.00. Shorter and lighter than the other mono units, its figures are: response 50-12000Hz; inherent noise 30dB; wind noise 50dB; sensitivity —78dB; maximum sound pressure level 120dB. The directivity pattern suggests good pickup from the front 190-degree sector, with pickup to the rear attenuated by up to 20dB.

Supplied complete with mic holder, collapsible desk stand, ⅜-inch adaptor and 3 metres of cable, the RP-3330 would appear to be a good choice for anyone who wants the most microphone for the least money.

For further details inquiries should be directed to Technics dealers or direct to Haco Distributing Agencies Pty Ltd, 57 Anzac Parade, Kensington, NSW. Tel (02) 662 1222.

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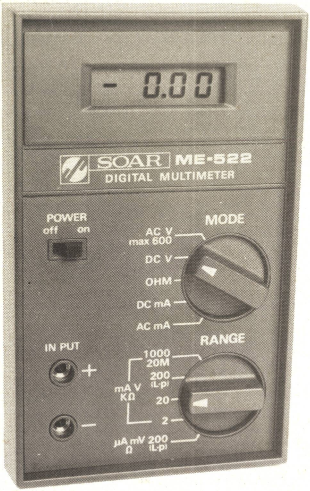

Specifications

Display: Liquid Crystal Display
Maximum indication: 1999 or -1999
Polarity: Automatic, negative polarity indication.
Zero adjustment: Automatic
Overrange indication: (1) or (-1) is displayed, in the first digit position.
Sampling time: 300 mSec
Battery voltage indication:
Operating temperature: 0 to 40ºC (32º to 104ºF) less than 80% RH
Accuracy temperature: 23º + 10ºC (73.4º + 50ºF) less than 75% RH
Power source: Single 9V transistor battery (NEDA 1904 or s —006p)
Power consumption: Approx 15mW
Battery Life: Zinc Carbon 150 to 200 hours.
Insulation voltage: Between the case and the input terminal and external input power jack; AC 1500V for one minute.
Size: 95mm (W) x 155mm (D) x 45mm (H); 3.74in.(W) x 6.10in.(D) x 1.77in.(H)
Weight: 300g (10.56oz) (excluding batteries)

Accessories:		
	Test lead (red)	1 pc
	Test lead (black)	1 pc
	Operator's manual	1 copy
	Battery	1 set
	Spare fuse (Located battery compartment)	1 pc

Electrical Specifications

AC Voltage Measurement

Range	Accuracy	Resolution	Input R.	Circuit protection
200mV	±(0.5% of rdg +0.3% of F.S +1dgt)	100µ V	10MΩ	AC350 V rms for 1 minute
2 V		1 mV		
20 V		10mV		
200 V		100mV		650 V rms for 1 minute
600 V		1 V		
Frequency response	40HZ ~ 1KHZ			

DC Voltage Measurement

Range	Accuracy	Resolution	Input R.	Circuit protection
200mV	±(0.25% of rdg + 1 dgt)	100µ V	10MΩ	DC±500 V or AC350 Vrms for 1 minute
2 V		1 mV		
20 V		10mV		
200 V		100mV		DC±1100 V or AC650 Vrms for 1 minute
1000 V	±(0.4% of rdg + 1 dgt)	1 V		

DC Current Measurement

Range	Accuracy	Resolution	Input R.	Voltage drop (in FS)	Circuit protection
200µ A	±(0.8% of rdg+1dgt)	0.1µ A	1 K	200mV	20mA for 1 minute
2mA		1 µ A	100Ω		60mA for 1 minute
20mA		10 µ A	10Ω		100mA for 1 minute
200mA	±(1% of rdg +1dgt)	100µ A	1 Ω		1 A Fuse
1 A		1 mA	0.12Ω	120mV	

AC Current Measurement

Range	Accuracy	Resolution	Input R.	Voltage drop (in FS)	Circuit protection
200µ A	±(1% of rdg +0.3% of F.S +1dgt)	0.1µ A	1 KΩ	200mV	20mA for 1 minute
2 mA		1 µ A	100 Ω		60mA for 1 minute
20mA		10µ A	10Ω		100mA for 1 minute
200mA	±(1.2% of rdg +1.3% F.S +1dgt)	100µ A	1 Ω		1 A Fuse
1 A		1 mA	0.12Ω	120mV	
Frequency response	40HZ ~ 1KHZ				

Resistance Measurement

Range	Accuracy	Resolution	Test current	Test power	Circit protection
200Ω	±(0.25% of rdg +1dgt)+0.2Ω	0.1Ω	1 mA	Lo	DC±30mA AC30mA for 1 minute
2 KΩ	±(0.25% of rdg +1dgt)	1 Ω	1 mA	Hi	
20KΩ		10Ω	100µ A		DC±100 V AC100 V rms for 1 minute
200KΩ		100Ω	1 µ A	Lo	
20MΩ	±(0.8% of rdg +1dgt)	10KΩ	0.1µ A	Hi	

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Soar 3½-digit DMM has LCD readout

A new portable digital multimeter with 3½-digit liquid crystal display has just been released by Soar Corporation of Japan. It offers longer battery life, higher resolution, improved accuracy and additional ranges compared with earlier models, at a very attractive price.

The new Soar model ME-522 digital multimeter is physically similar to the earlier model ME-521 reviewed in our February 1978 issue. The external dimensions are the same, 95 x 155 x 45mm, and the panel layout is almost identical. However a close inspection soon shows that the new meter is significantly different from its predecessor, and improved in quite a number of ways.

The most obvious difference is that the new meter has a liquid-crystal display in place of LEDs. This makes the instrument much easier to read in conditions of high ambient lighting, as well as providing a drastic reduction in power consumption. In fact the total power consumption of the ME-522 is only 15 milliwatts — so that its 9V battery (916 type) has a typical life of between 150 and 200 hours!

The LCD panel used has digits of around 8mm high, and with a good contrast ratio, making them clearly readable at all normal viewing distances. It also has a special "BATT" legend which is normally invisible, but becomes visible when the battery is reaching the end of its life.

The display of the ME-522 is 3½ digits, compared with the 3 of the earlier model. This gives greater range overlap, and hence a higher average resolution. In addition the new meter has a fifth position on the range switch, giving an extra measuring range on all five modes.

The most sensitive range in both the DC and AC voltage measurement modes is now a nominal 200mV range, giving 100uV resolution in both cases. The next three ranges have nominal fullscale readings of 2V, 20V and 200V, with the final range designated 1000V for DCV and 600V for ACV. Input resistance in both modes is 10M on all ranges.

Rated accuracy on the four lowest DCV ranges is ±0.25% of reading ±1 digit, and for the highest range it is ±0.4% of reading ±1 digit. These are significantly better than the earlier model, and excellent figures for a low cost portable instrument.

Rated accuracy on all ACV ranges is ±0.5% of reading ±0.3% of full scale ±1 digit, which is again better than the earlier model. Frequency response on the ACV ranges is from 40Hz to 1kHz.

The DC and AC (current) modes each have five ranges, with the same nominal full scale figures: 200uA, 2mA, 20mA, 200mA and 1A. Minimum resolution is thus 0.1uA, an order lower than the earlier instrument. Voltage drop on the four lowest ranges in both modes is 200mV, falling to 120mV on both 1A ranges.

Rated accuracy for the three lowest DC ranges is ±0.8% of reading +1 digit, and for the two highest ranges ±1% of reading ±1 digit. For the AC ranges the correspnding figures are ±1% of reading ±1 digit, and +1.2% of reading +1 digit. Frequency response on the AC ranges is again 40Hz—1kHz.

The five resistance ranges have nominal full scale readings of 200 ohms, 2k, 20k, 200k and 20M. The minimum resolution is thus 0.1 ohm, and the maximum value measureable is 19.99M — both significantly improved compared with the earlier model.

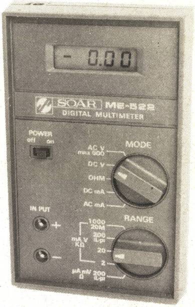
Rated accuracy on the three middle resistance ranges is ±0.25% of reading ±1 digit, with the lowest range having the same figure but qualified by a further factor of ±0.2 ohms. The highest range figures are +0.8% of reading ±1 digit. All of these figures are significantly better than for the earlier model, and are excellent for this class of meter.

It is interesting to note that on two of the resistance ranges, the test current has been deliberately reduced so that the maximum voltage drop produced across the measured resistance is 300mV instead of 2V. This allows these "low power" ranges to be used for in-circuit measurements around semiconductors, as the 300mV will be insufficient to forward bias most semiconductor junctions.

The ME-522 is overload protected on all modes and ranges, like the earlier model. Similarly it uses a 1A fuse to protect the current ranges, and the fuse together with a spare is located in the battery compartment for easy accessibility.

Over-range indication is achieved by having the three full display digits blank out, leaving only the "1" visible.

Incidentally the case of the meter appears to be moulded in "Cycolac" or a similar high impact resistant plastic, making it quite rugged.



The meter comes complete with a pair of test leads, a battery and an operator's manual. An optional AC adapter is available if required.

We were able to examine, test and use the sample ME-522 meter pictured, and we were most impressed. It gave every evidence of being soundly engineered, and our impression is that the designers have made considerable effort to overcome any criticisms one might have made about the earlier model. The controls are very convenient to use, and the ranges now entirely adequate for all normal applications.

Perhaps the only minor shortcomings remaining are the restricted frequency response on AC ranges, and the lack of a tilting foot or bail.

Checked against our known voltage and resistance references, its accuracy proved to be well within the claimed tolerances. Reading stability was good too, with very little "bobble". Zero stability was good on all ranges and modes.

In short, the Soar model ME-522 seems to us a most impressive little meter, and one whose compactness, high accuracy and low power consumption should make it very suitable for both bench and field. At the quoted price of $99.50 plus tax, it seems excellent value for money.

The review sample came from Radio Despatch Service of 869 George Street, Sydney, who advise that they have good stocks. The ME522 is also available from Ampec Engineering Co Pty Ltd, of 1 Wellington St, Rozelle NSW or P.O. Box 18, Strathfield 2135. (J.R.)

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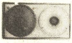

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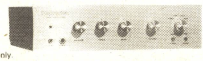

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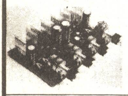

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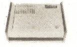

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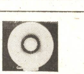

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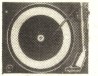

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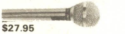

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6K7G
6KV8
6K8
6K8G
6SA7
6SN7
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6V9
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6X2
7R7
7V7
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9U8
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Letters to the editor

Red face department

There is a small spelling error in the article you published in the June 1978 issue on page 43, describing the construction of an audio sine and squarewave oscillator. The bridge oscillator concerned is due to Max Wien, not Wein as used incorrectly in the article.

P. L. Wiesner,
Brunswick, Victoria.

COMMENT: You're quite right, of course. A gremlin must have slipped it through without anyone noticing.

PIPBUG problem

I am writing to inform you and your readers of a minor but irritating design bug in PIPBUG, the monitor/debug program used in your 2650 microprocessor projects. Before executing a program, PIPBUG clears the PSU register, unless you have purposely preset it. This sets the 2650 flag output low, and hence puts a "space" on the 20mA line to the terminal. The effect of this is to upset the terminal, which interprets the space as a false start bit.

Even if the program begins sending a series of characters to the terminal soon after it begins running, this tends to cause the terminal to receive the first character or two out of step.

The solution, rather than to manually preset the PSU to 40 each time, is to start each program with a PPSU instruction, hex code 76 40. This restores the 20mA line to the correct "mark" condition within microseconds of the program starting to run.

Alan Peek,
Woolwich, NSW.

COMMENT: We ourselves were aware of this, and many of the programs on our 2650 software record start with a PPSU instruction for this reason. But thanks for reminding us that we hadn't told readers!

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7403	.25	.23	7440	.30	.25	7493	.75	.70
7404	.37	.33	7441	1.50	1.40	7496	1.25	1.20
7405	.37	.33	7442	.70	.65	7497	4.00	3.50
7406	.80	.75	7443	2.10	1.75	74107	.65	.60
7407	.50	.45	7444	2.10	1.75	74121	.60	.55
7408	.34	.28	7445	1.66	1.39	74123	1.10	1.05
7409	.34	.28	7446	1.50	1.40	74125	1.25	1.10
7410	.30	.25	7447	1.25	1.15	74126	.80	.75
7411	.37	.33	7448	1.25	1.15	74132	1.75	1.65
7412	.30	.25	7450	.35	.32	74137	2.10	2.00
7413	.54	.47	7451	.35	.32	74141	1.35	1.30
7414	1.03	.95	7454	.30	.25	74145	2.00	1.80
7416	.60	.55	7470	.65	.60	74150	1.80	1.70
7417	.60	.55	7472	.45	.40	74153	1.10	1.00
7420	.30	.25	7473	.60	.55	74154	1.70	1.50
7421	.30	.25	7474	.65	.60	74155	1.50	1.40
7423	.53	.45	7475	.65	.60	74156	2.10	1.90
7425	.53	.45	7480	1.25	1.20	74162	2.70	2.50
7426	.45	.40	7482	1.65	1.55	74163	1.90	1.70
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4002	.25	.23	4024	.90	.85	4053	1.20	1.10
4006	1.40	1.30	4025	.40	.35	4066	.90	.85
4007	.25	.23	4027	.80	.75	4068	.40	.38
4008	1.25	1.20	4028	1.25	1.20	4069	.35	.30
4011	.25	.23	4029	1.90	1.60	4070	.40	.35
4012	.25	.23	4032	1.00	.90	4072	.40	.35
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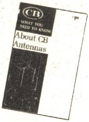

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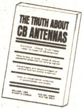

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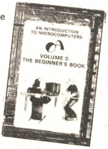

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This book is an attempt to cover as many aspects as possible of amateur communications satellites (OSCARS, and in many respects is the most comprehensive treatment of the subject we have seen so far.

Chapter 1, Planets and their orbits, includes brief historical references to the beliefs of early astronomers. From this it progresses to the modern concept of our solar system, and the laws which govern its behaviour.

Chapter 2, Satellites and their Orbits, discusses the mechanics of artificial satellites under such headings as: What keeps a satellite up, the Mercator map, orbital height, period, and speed, etc.

It is not possible to discuss all the chapters in detail, but the headings are as follows: Chapter 3, Anatomy of a Satellite; Chapter 4, Satellites as Relay Stations; Chapter 5, Fundamentals of Telecommunication via Satellites; Chapter 6, Telemetry Systems; Chapter 7, Satellites of the OSCAR Series; Chapter 8, Operating with Amateur Satellites; Chapter 9, Learning with AMSAT-OSCAR Satellites. There is also a brief description of OSCAR-8, a list of abbreviations and symbols, and a bibliography.

Two of the chapters, numbers five and eight, should be of particular interest to the amateur wishing to get started in satellite communications.

Chapter 5 is devoted to "budgeting" the signal losses and gains involved in satellite communications; the losses due to distance and frequency, against the gains of aerials at both ends. It includes a useful chart giving space loss attenuation, plus the formula from which it is derived.

Much of chapter 8 is devoted to methods of calculating a satellite's position, using published data, graphs, maps, tables, formulas, and devices such as "Oscarlocator".

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INFORMATION CENTRE

STEREO CASSETTE DECK: I am making the stereo cassette deck published in the February 1978 issue (File No. 1/RA/34) as my first hifi project. I am rather appalled at the wiring diagrams and picture which try to show how to do the wiring to the PCB. I have had several experienced people try to work it out but the only way they say they could do it is to trace the whole circuit through.

I am also wondering why the output has only two wires and the input has four wires. Could you please tell me which of the terminals of the Playmaster 25/25 stereo amp they go to. I know they go to Tape Out sockets but which contacts, centre or outer ones.

I would really appreciate it if you can help me out in these things. I hope all of your projects are not as mixed up and unclear as the cassette deck. (G.T., Heathmont, Vic.)

- We indicated, at two places in the article, that this was a challenging project. So perhaps it is unfortunate that you pick it as your first stereo project. The diagrams and text are intended as a guide to tracing the circuit of the mechanism PCB so that cuts to the PCB and interconnections can be made. Rather than show all the cables and wires, the connections are shown numbered, for clarity. We are sorry you find it confusing, but persevere and you will find the end result worthwhile.

Both the high and low level inputs are run in shielded cable because they are high impedance. The output (from S105C1 and S105C2) is low impedance and a relatively high level of about 1 volt RMS, and therefore does not need shielding. The earth return of the output is via the shield of the high level input cable. The outer contacts of the four-way RCA connector are connected together, as shown in the diagram; these become the earth point for the deck.

Notes & Errata

PLAYMASTER TWIN 25 and 40/40 (April to June 1976, File Nos 1/SA/55-58, December 1976, January 1977, File Nos 1/SA/59,60). In those amplifiers with the optional loudspeaker protector fitted, the positive supply to the protector PCB should be taken from the rectifier side of one of the positive rail fuseholders rather than from the collector of T13. This avoids a possible danger to the loudspeakers if the fuse associated with T13 blows and removes power to the protector PCB.

ELECTRONIC KEYER (March, 1977, File No. 3/MS/74): The two 10k resistors at the inputs from the paddle are incorrectly placed on the PCB, compared with the circuit diagram. There is no apparent degrading in performance as a result and they may be left as they are. However, readers who wish to adhere strictly to the circuit may reconnect the 10k resistors underneath the board.

LOW COST VDU KEYBOARD MODULE (April 1978, File No. 2/CC/25). In the overlay diagrams on page 53, the E and C connections to the BC558 transistor are shown transposed. The circuit diagram on page 49 is correct.

WIEN BRIDGE OSCILLATOR (June 1978, File No. 7/AO/28): The 2.2uF capacitor connected to pins 2 and 6 of the 555 is shown with reversed polarity on the overlay diagram. The circuit is correct. The parts list should 220k as the first resistor, not 22k, while two 470 ohm resistors are required not one. Also in order to achieve correct operation with some 555 chips, the 2.2k resistor connected to pin 5 may need to be altered in value. Set the pin 5 voltage to 2V DC.

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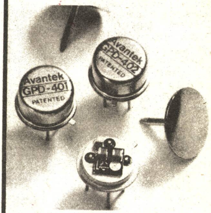

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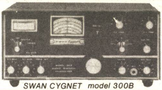

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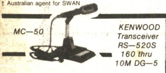

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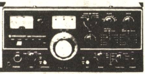

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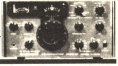

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How does the UD-XL I compare then, with ordinary low-noise tapes?

Sensitivity is higher by 2.5 dB, and MOL performance by as much as 6 dB.

Yet, for all this UD-XL I requires no special bias or equalization. Simply set your tape selector as you normally would at the ferric position – but there the comparison ends.

UD-XL II TAPE, FOR THE CHROME POSITION (70*us*)

UD-XL II tape is such a dramatic improvement on most other tape that can be used in this position, that comparison is really unfair.

For example, if you're familiar with conventional chromium-dioxide tape, you'll know of the associated problems of poor output uniformity – plus low maximum output level and rather high distortion.

UD-XL II tape offers you excellent MOL, sensitivity, and an output improvement of more than 2 dB over the entire frequency range.

Maxell's unique 'Epitaxial' process gives you absolute sensitivity and stability, and no drop-out problems. What's more, the shells are moulded in diamond cut dies, and made to tolerances 5 times greater than the Philips standard. And, like all Maxell tapes, UD-XL II has the 5-second cleaning leader.

In short, if you're recording in the chrome position, you can now achieve all the advantages – with none of the drawbacks.

A prospect we think you'll find very exciting – even if the competition don't.

UD XL II

UD XL I

maxel

simply excelle

For details on all Maxell Recording Tape write to Maxell Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033